User's Manual

EXA

CE

EXA 202
Fieldbus Communication

IM 12A00A01-61E

vigilantplant®

YOKOGAWA

Yokogawa Electric Corporation

IM 12A00A01-61E
2nd Edition

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REVISION RECORD.....1

1. INTRODUCTION

In the standard user's manual delivered with the 202 analyzer all necessary information about HART-communication is included. This manual describes only those topics that are required for operation of the fieldbus communications.
For information about instruments related to the EXA202, refer to the following User's Manuals.

Manual Name	IM No.	Instruments mentioned
2-wire pH/ORP Transmitter	IM 12B07D02-01E	PH202G, PH202S
2-wire Conductivity or Resistivity Transmitter	IM 12D08B02-01E	SC202G, SC202S
2-wire Inductive Conductivity Transmitter	IM 12D06A03-01E	ISC202G, ISC202S
2-wire Dissolved Oxygen Transmitter	IM 12J05C01-01E	DO202G, DO202S

T01.EPS

2. SAFETY PRECAUTIONS

- For the protection and safety of the operator and the instrument or the system including the instrument, please be sure to follow the instructions on safety described in this manual when handling this instrument. In case the instrument is handled in contradiction to these instructions, Yokogawa does not guarantee safety.
- For the intrinsically safe equipment and explosionproof equipment, in case the instrument is not restored to its original condition after any repair or modification undertaken by the customer, intrinsically safe construction or explosionproof construction is damaged and may cause dangerous condition. Please contact Yokogawa for any repair or modification required to the instrument.
- The following safety symbol marks are used in this Manual:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

NOTE

Draws attention to information essential for understanding the operation and features.

WARNING

- Instrument installed in the process is under pressure. Never loosen or tighten the process connector bolts as it may cause dangerous spouting of process fluid.
- During draining condensate or venting gas in transmitter pressure-detector section, take appropriate care to avoid contact with the skin, eyes or body, or inhalation of vapors, if the accumulated process fluid may be toxic or otherwise harmful.
  Since draining condensate or bleeding off gas gives the pressure measurement distur-bance, this should not be done when the loop is in operation.
- If the accumulated process fluid may be toxic or otherwise harmful, take appropriate care to avoid contact with the body, or inhalation of vapors even after dismounting the instrument from process line for maintenance.

CAUTION

This instrument is tested and certified as intrinsically safe type or explosionproof type. Please note that the construction of the instrument, installation, external wiring, maintenance or repair is strictly restricted, and non-observance or negligence of these restriction would result dangerous condition.

3. FOUNDATION FIELDBUS

3-1 About Foundation Fieldbus

3-1-1 Outline

Fieldbus is a bi-directional digital communication protocol for field devices, which offers an advancement implementation technologies for process control systems and is widely employed by numerous field devices.

EXA Series Fieldbus communication type employs the specification standardized by The Fieldbus Foundation, and provides interoperability between Yokogawa devices and those produced by other manufacturers. Fieldbus comes with software consisting of three AI function blocks, providing the means to implement flexible instrumentation system.

For information on other features, engineering, design, construction work, startup and maintenance of Fieldbus, refer to http://www.yokogawa.com/fbs/fbs-index.htm.

3-1-2 Internal Structure of EXA

The EXA contains two virtual field devices (VFD) that share the following functions.

3-1-2-1 System/network Management VFD

- Sets node addresses and Physical Device tags (PD Tag) necessary for communication
- Controls the execution of function blocks
- Manages operation parameters and communication resources (Virtual Communication Relationship: VCR)

3-1-2-2 Function Block VFD

(1) Resource block

- Manages the status of EXA hardware
- Automatically informs the host of any detected faults or other problems

(2) Transducer block

- Converts sensor output to process values and transfers to AI function block by channels

(3) AI1, AI2, AI3 function block

- Conditions raw data from the Transducer block
- Outputs conditioned process values
- Carries out scaling, damping and square root extraction

3-1-3 Logical Structure of Each Block

Setting of various parameters, node addresses, and PD Tags shown in Figure 3.1 is required before starting operation.

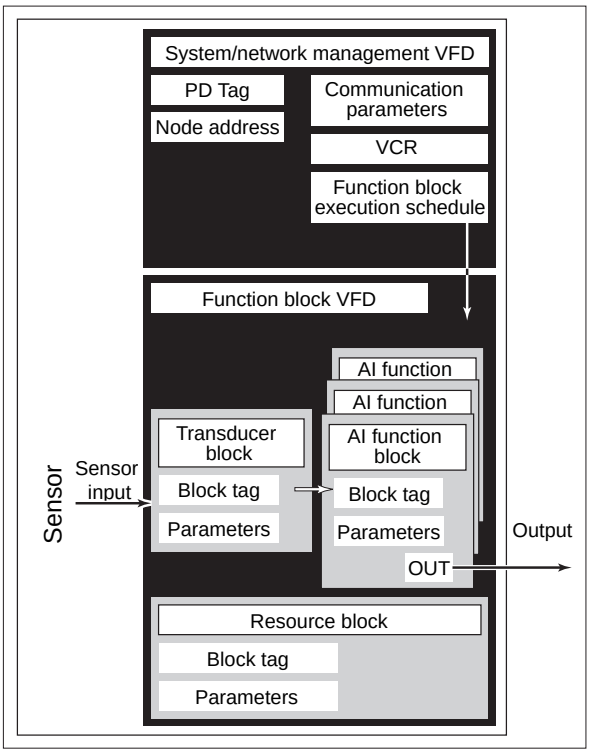


Figure 3.1 Logical Structure of Each Block

3-1-4 Wiring System Configuration

The number of devices that can be connected to a single bus and the cable length vary depending on system design. When constructing systems, both the basic and overall design must be carefully considered to allow device performance to be fully exhibited.

3-2 Getting started

Fieldbus is fully dependent upon digital communication protocol and differs in operation from conventional 4 to 20 mA transmission communication protocol. It is recommended that novice users use field devices in accordance with the procedures described in this section. The procedures assume that field devices will be set up on a bench or an instrument shop.

3-2-1 Connection of Devices

3-2-1-1. Fieldbus Preparation

The Foundation Fieldbus® connections and the sensor connections should be made in accordance with figure 3.2 and 3.3. The terminals are of a plug in style for ease of mounting.
The EXA 202 FF is provided with two cable glands. The first is used for the electrode wiring as the other is used for the power/foundation® Fieldbus wiring shown in figure 3.2.
To open the EXA 202 for wiring:

1. Loosen the four frontplate screws and remove the cover.
2. The terminal strip is now visible.
3. Connect the power supply to the green connector according figure 3.3. Use the gland on the left for this cable.
4. Connect the sensor input, using the gland on the right (see figure 3.2). Switch on the power. Commission the instrument as required or use the default settings.
5. Replace the cover and secure frontplate with the four screws.

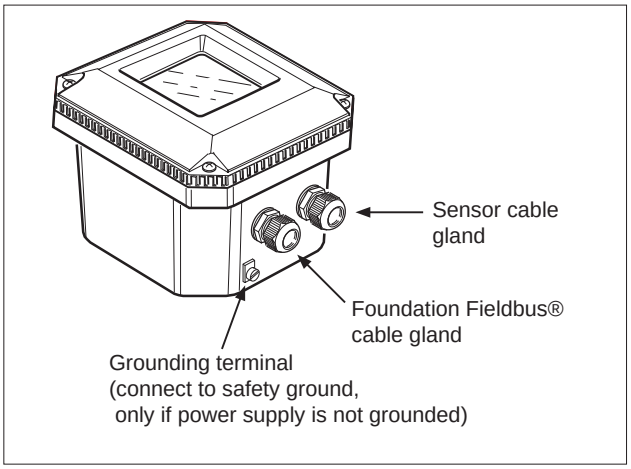


Figure 3.2 Glands to be used for cabling

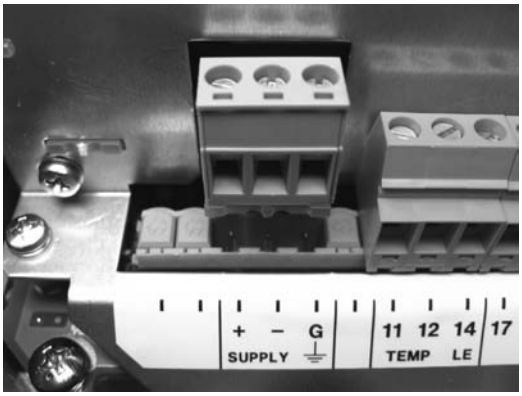


Figure 3.3 Green connector for power supply

3-2-1-2. Cables, terminals and glands

The EXA202 is equipped with terminals suitable for the connection of finished cables in the size range: 0.13 to 2.5 mm (26 to 14 AWG). The glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm (0.24 to 0.47 inches).

The following instruments are required for use with Fieldbus devices:

- **Power supply**
  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.

- **Terminator**
  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.

- **Field devices**
  Connect EXA Fieldbus communication type.
  Two or more EXA devices or other devices can be connected.

- **Host**
  Used for accessing field devices. A dedicated host (such as DCS) is used for an instrumentation line while dedicated communication tools are used for experimental purposes. For operation of the host, refer to the instruction manual for each host. No details of the host are explained in the rest of this material.

- **Cable**
  Used for connecting devices. Refer to “Fieldbus Technical Information” (TI 38K03A01-01E) for details of instrumentation cabling.
  Fieldbus uses twisted pair wires. To meet the Electro Magnetic Interference standards a shielded twisted pair is obligated.

Refer to Yokogawa when making arrangements to purchase the recommended equipment.

Connect the devices as shown in Figure 3.4. Connect the terminators at both ends of the trunk, with a minimum length of the spur laid for connection.

The polarity of signal and power must be maintained.

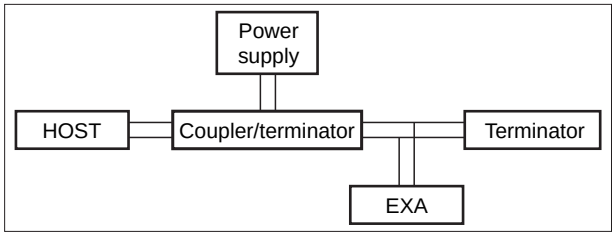


Figure 3.4 Cabling

NOTE

Before using a Fieldbus configuration tool other than the existing host, confirm it does not affect the loop functionality in which all devices are already installed in operation. Disconnect the relevant control loop from the bus if necessary.

⚠ IMPORTANT

Connecting a Fieldbus configuration tool to a loop with its existing host may cause communication data scrambles resulting in a functional disorder or a system failure.

3-2-2 Host Setting

To activate Fieldbus, the following settings are required for the host.

IMPORTANT

Do not turn off the power immediately after setting. When the parameters are saved to the EEPROM, the redundant processing is executed for an improvement of reliability. If the power is turned off within 60 seconds after setting is made, the modified parameters are not saved and the settings may return to the original values.

Table 3.1 Operation Parameters

Symbol	Parameter	Description and Settings
V (ST)	Slot-Time	Set 4 or greater value.
V (MID)	Minimum-Inter-PDU-Delay	Set 4 or greater value.
V (MRD)	Maximum-Reply-Delay	Set so that V (MRD) X V (ST) is 12 or greater
V (FUN)	First-Unpolled-Node	Define the first address that can be used by the host. Set 0x15 or greater.
V (NUN)	Number-of-consecutive-Unpolled-Node	This sets the number of consecutive unpolled nodes. EXA address is factory-set to 0xEB. Set this address to be within the range of the BASIC device in Figure 3.5.

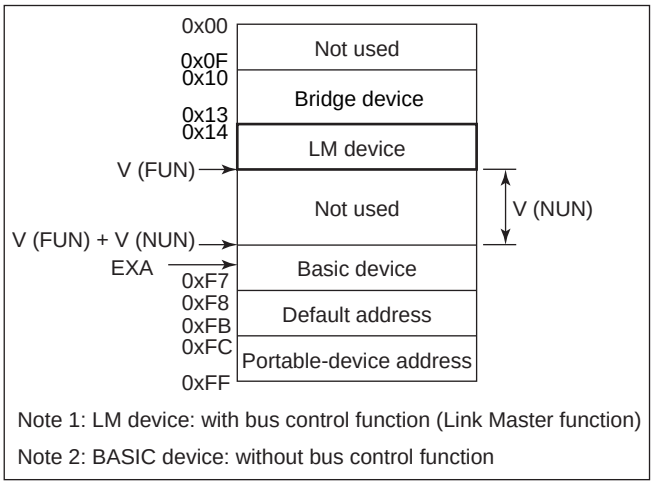


Figure 3.5 Available Address Range

3-2-3 Bus Power ON

Turn on the power of the host and the bus. First all segments of the display are lit, then the display begins to operate. If the indicator is not lit, check the polarity of the power supply.

Using the host device display function, check that the EXA is in operation on the bus.
Unless otherwise specified, the following settings are in effect when shipped from the factory.

	PH202	SC202	ISC202	DO202
PD tag	PH1001	SC1001	ISC1001	DO1001
Node addr.	232	233	234	235
DEV_TYPE	0x0830	0x0831	0x0832	0x0833

If no EXA is detected, check the available address range and the polarity of the power supply. If the node address and PD tag are not specified when ordering, default value is factory set. If two or more EXA's are connected at a time with default value, only one EXA will be detected from the host as EXA's have the same initial address.
Separately connect each EXA and set a different address for each.

3-2-4 Integration of DD

If the host supports DD (Device Description), the DD of the EXA needs to be installed. Check if host has the following directory under its default DD directory.

594543\DEV_TYPE
(594543 is the manufacturer number of Yokogawa Electric Corporation, and DEV_TYPE is the EXA device number, respectively.)
If this directory is not found, DD of EXA has not been included. Create the above directory and copy the DD file (0m0n.ffo,0m0n.sym) (m, n is a numeral) (to be supplied separately) into the directory.

Once the DD is installed in the directory, the name and attribute of all parameters of the EXA are displayed.

Off-line configuration is possible by using Capability file (CFF).

3-2-5 Reading the Parameters

To read EXA parameters, select the AI1 block of the EXA from the host screen and read the OUT parameter. The current process value is displayed. Check that MODE_BLOCK of the function block and resource block is set to AUTO.

3-2-6 Continuous Record of Values

If the host has a function of continuously recording the indications, use this function to list the indications (values). Depending on the host being used, it may be necessary to set the schedule of Publish (the function that transmits the indication on a periodic basis).

3-2-7 Generation of Alarm

If the host is allowed to receive alarms, generation
of an alarm can be attempted from EXA. In this case, set the reception of alarms on the host side. EXA's VCR-7 is factory-set for this purpose. For practical purposes, all alarms are placed in a disabled status; for this reason, it is recommended that you first use one of these alarms on a trial basis. Set the value of link object-3 (index 30002) as "0, 299, 0, 6, 0". Refer to section 3-3-6-1 Link Object for details.

Since the LO_PRI parameter (index 4029) of the AI1 block is set to "0", try setting this value to "3". Select the Write function from the host in operation, specify an index or variable name, and write "3" to it.

The LO_LIM parameter (index 4030) of the AI1 block
determines the limit at which the lower bound alarm for the process value is given. In usual cases, a very small value is set to this limit. Set a value higher than the current process value, a lower bound alarm is raised. Check that the alarm can be received at the host. When the alarm is confirmed, transmission of the alarm is suspended.

The above-mentioned items are a description of the simple procedure to be carried out until EXA is connected to Fieldbus. In order to take full advantage of the performance and functionality of the device, it is recommended that it be read together with Chapter 5 of relevant User's Manual, which describes how to use the EXA.

3-3 Configuration

This chapter contains information on how to adapt the function and performance of the EXA to suit specific applications. Because two or more devices are connected to Fieldbus, settings including the requirements of all devices need to be determined. Practically, the following steps must be taken.

(1) Network design
Determines the devices to be connected to Fieldbus and checks the capacity of the power supply.

(2) Network definition
Determines the tag and node addresses for all devices.

(3) Definition of combining function blocks
Determines the method for combination between each function block.

(4) Setting tags and addresses
Sets the PD Tag and node addresses one by one for each device.

(5) Communication setting
Sets the link between communication parameters and function blocks.

(6) Block setting
Sets the parameters for function blocks.

The following section describes each step of the procedure in the order given. Using a dedicated configuration tool allows the procedure to be signifi-cantly simplified. This section describes the procedure to be assigned for a host which has relatively simple functions.

3-3-1 Network Design

Select the devices to be connected to the Fieldbus network. The following instruments are necessary for operation of Fieldbus.

- **Power supply**
  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is. A power conditioner is reguired.

- **Terminator**
  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.

- **Field devices**
  Connect the field devices necessary for instrumentation. EXA has passed the interoperability test conducted by The Fieldbus Foundation. In order to properly start Fieldbus, it is recommended that the devices used satisfy the requirements of the above test.

- **Host**
  Used for accessing field devices. A minimum of one device with bus control function is needed.

- **Cable**
  Used for connecting devices. Refer to “Fieldbus Technical Information” for details of instrumentation cabling. Provide a cable sufficiently long to connect all devices. For field branch cabling, use terminal boards or a connection box as required.

First, check the capacity of the power supply. The power supply capacity must be greater than the sum of the maximum current consumed by all devices to be connected to Fieldbus. The maximum current consumed (power supply voltage 9 to 32 V) for EXA is 26.0 mA. The cable must have the spur in a minimum length with terminators installed at both ends of the trunk.

3-3-2 Network Definition

Before connection of devices with Fieldbus, define the Fieldbus network. Allocate PD Tag and node addresses to all devices (excluding such passive devices as terminators).

The PD Tag is the same as the conventional one used for the device. Up to 32 alphanumeric characters may be used for definition. Use a hyphen as a delimiter as required.

The node address is used to specify devices for communication purposes. Because data is too long for a PD Tag, the host uses the node address in place of the PD Tag for communication.
A range of 20 to 247 (or hexadecimal 0x14 to 0xF7) can be set.

Addresses of devices with Link Master capabilities are set in a low address range smaller than V(FUN).
Addresses of basic devices are set in a higher range bigger than V(FUN) + V(NUN).
Specify the adress range used by setting the following two parameters in the LM-device:

Table 3.2 Parameters for Setting Address Range

Symbol	Parameters	Description
V (FUN)	First-Unpolled-Node	Indicates the address next to the address range used for the host or other LM device.
V (NUN)	Number-of-consecutive-Unpolled-Nodes	Unused address range

The devices within the address range written as “Not used” in Figure 3.6 cannot be used on a Fieldbus. For other address ranges, the range is periodically checked to identify when a new device is connected. Care must be taken not to allow the address range to become wider, which can lead to exhaustive consumption of Fieldbus communication performance.

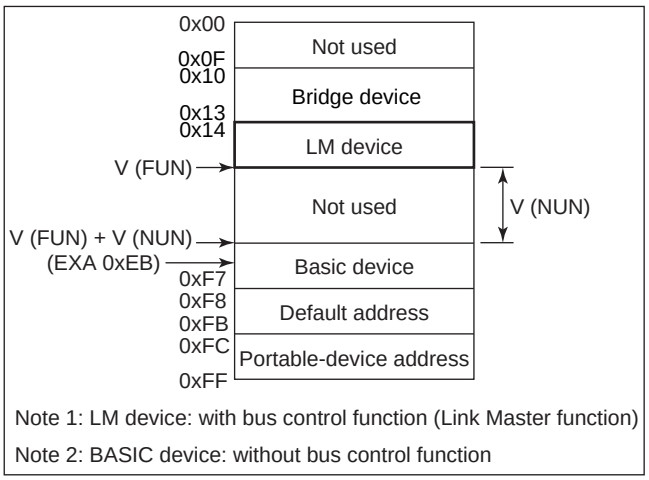


Figure 3.6 Available Range of Node Addresses

To ensure stable operation of Fieldbus, determine the operation parameters and set them to the LM devices. While the parameters in Table 3.3 are to be set, the worst-case values of all the devices to be connected to the same Fieldbus must be used. Refer to the specification of each device for details. Table 3.3 lists EXA specification values.

Table 3.3 Operation Parameter Values of the EXA to be Set to LM Devices

Symbol	Parameters	Description and Settings
V (ST)	Slot-Time	Indicates the time necessary for immediate reply of the device. Unit of time is in octets (256 µs). Set maximum specification for all devices. For EXA, set a value of 4 or greater.
V (MID)	Minimum-Inter-PDU-Delay	Minimum value of communication data intervals. Unit of time is in octets (256 µs). Set the maximum specification for all devices. For EXA, set a value of 4 or greater.
V (MRD)	Maximum-Reply-Delay	The worst case time elapsed until a reply is recorded. The unit is Slot-time; set the value so that V (MRD) 3V (ST) is the maximum value of the specification for all devices. For EXA, the setting must be a value of 12 or greater.

3-3-3 Definition of Combining Function Blocks

The input/output parameters for function blocks are combined. For the EXA, three AI blocks output parameter (OUT) are subject to combination. They are combined with the input of the control block as necessary. Practically, setting is written to the EXA link object with reference to “Block setting” in Section 3-3-6 for details. It is also possible to read values from the host at proper intervals instead of connecting the EXA block output to other blocks.

The combined blocks need to be executed synchronously with other blocks on the communications schedule. In this case, change the EXA schedule according to the following table. Enclosed values in the table are factory-settings.

Table 3.4 Execution Schedule of the EXA Function Blocks

Index	Parameters	Setting (Enclosed is factory-setting)
269(SM)	MACROCYCLE_DURATION	Cycle (MACROCYCLE) period of control or measurement. Unit is 1/32 ms. (32000 = 1 s)
276(SM)	FB_START_ENTRY.1	AI1 block startup time. Elapsed time from the start of MACROCYCLE specified in 1/32 ms. (0 = 0 s)
277(SM)	FB_START_ENTRY.2	AI2 block startup time. Elapsed time from the start of MACROCYCLE specified in 1/32 ms. (9600 = 0.3 s)
278(SM)	FB_START_ENTRY.3	AI3 block startup time. Elapsed time from the start of MACROCYCLE specified in 1/32 ms. (19200 = 0.6 s)
279(SM) to 289(SM)	FB_START_ENTRY.4 to 14	Not used.

A maximum of 29 ms is taken for execution of an AI block. Executions of AI blocks should be scheduled sequentially. In no case should two AI function blocks of the EXA be executed at the same time (execution time is overlapped). 29 ms after AI block execution start the out value is available for further processing. Figure 3.8 shows an example of schedule based on the loop shown in Figure 3.7.

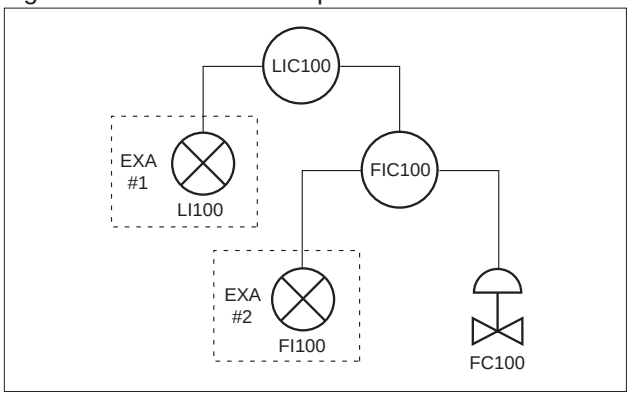


Figure 3.7 Example of Loop Connecting Function Block of Two EXA with Other Instruments

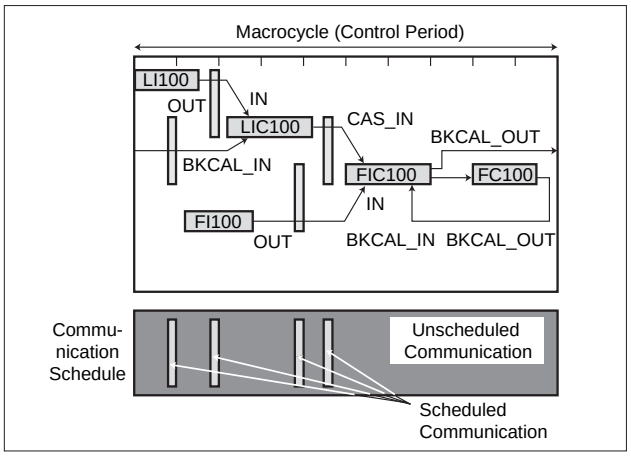


Figure 3.8 Function Block Schedule and Communication Schedule

When the macrocycle is set to more than 4 seconds, set the following intervals to be more than 1% of the macrocycle.
- Interval between “end of block execution” and “start of sending CD from LAS”
- Interval between “end of block execution” and “start of the next block execution”

3-3-4 Setting of Tags and Addresses

This section describes the steps in the procedure to set PD Tags and node addresses in the EXA. There are three states of Fieldbus devices as shown in Figure 3.9, and if the state is other than SM_ OPERATIONAL state, no function block is executed. EXA must be transferred back to this state after a tag or address is changed.

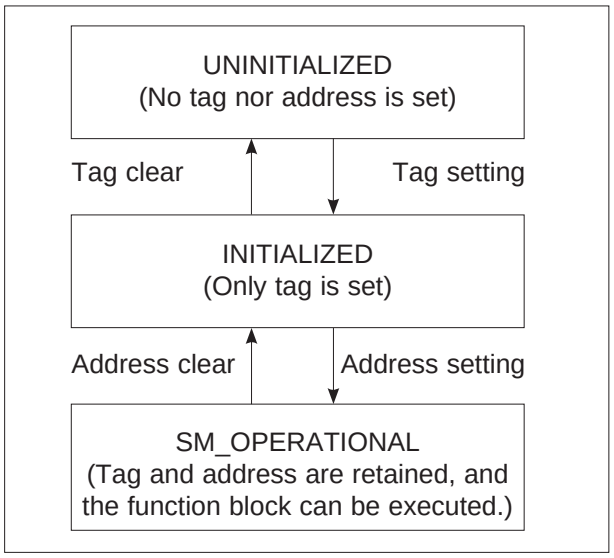


Figure 3.9 Status Transition by Setting PD Tag and Node Address

EXA has a PD Tag and node address that are set upon shipment from the factory unless otherwise specified. To change only the node address, clear the address once and then set a new node address. To set the PD Tag, first clear the node address and clear the PD Tag, then set the PD Tag and node address again.

Devices whose node address was cleared will await the default address (randomly chosen from a range of 248 to 251, or from hexadecimal F8 to FB). It is necessary to confirm the device ID in order to correctly specify the device. The device ID of the EXA is 594543083xxxxxxxxx. (The xxxxxxxxx at the end of the above device ID is a total of 9 alphanumeric characters. The characters displyed on the screen when each instrument is powered on, correspond to the xxxxxxxxx and if necessary, should be recorded.)

3-3-5 Communication Setting

To set the communication function, it is necessary to change the database residing in SM-VFD.

3-3-5-1 VCR Setting

Set VCR (Virtual Communication Relationship), which specifies the called party for communication and resources. EXA has 33 VCRs whose application can be changed, except for the first VCR, which is used for management.

EXA has VCRs of 3 types:

Publisher(-Subscriber) VCR

Publisher-Subscriber VCR's are designed to link Function Blocks. When a publishing Function Block runs, its output data is stored in the buffer of the Publisher VCR. Then the LAS (LM) sends a CD to this VCR to force it to transfer the data. Subscriber VCRs receive this data and gives this to the subscribing Function Blocks. Typical example is a linkage from an output of an Analog Input (AI) block to the process value input of the PID control block.

Publisher-Subscriber model is one-to-many one-way Communication. Subscribers are able to know whether data is updated since the last publish. This mechanism is important because Data Link Layer transfers data as scheduled regardless the publishing Function Block updates the data in the buffer.

(Client-)Server Model

Client-Server model is universal and used in many communication technologies. An application called "Client" requests another application called "Server" to do a specific action. When the Server finishes the requested action, its result is transferred back to the Client. It is an one-to-one two-way communication. Typical example is a human-machine interface (Client) to read data of a Function Block (Server). The Client sends a Read request to the Server and then the Server sends back the data to the Client. This communication is unscheduled and is handled during the unscheduled interval in the macrocycle. A Client may want to issue many requests at a time. A Client-Server VCR has a queue to store those requests and sends the requests one by one when the node has the token.

Source(-Sink) Model

A Source-Sink VCR is designed to broadcast messages. It is one-to-many one-way communication without any schedule. This model is sometimes called "Report Distribution Model." A Source VCR transfers a message in the queue to an assigned global address when the device has the token. Sink VCRs are set to the same global address and receive the same message from a Source. Foundation devices use this model for two specific purposes. One is to report alarms or events detected in the Source and the other is to transmit trends of Source Function Blocks. Alarms are acknowledged through a Client-Server VCR. It is desirable for an alarm logger to receive alarms from all devices with just one VCR. A Sink can receive messages from many Sources if the Sources are configured to send messages to the same global address.

A Source VCR transmits data without established connection. A Sink (QUU) VCR on another device can receive it if the Sink is configured so. A Publisher VCR transmits data when LAS requests so. An explicit connection is established from VCR(s) so that a Subscriber knows the format of published data.

Each VCR has the parameters listed in Table 3.5. Parameters must be changed together for each VCR because modification for each parameter may cause inconsistent operation.

Table 3.5 VCR Static Entry

Sub-index	Parameter	Description
1	FasArTypeAndRole	Indicates the type and role of communication (VCR). The following 3 types are used for EXA. 0x32: Server (Responds to requests from host.) 0x44: Source (Transmits alarm or trend.) 0x66: Publisher (Sends AI block output to other blocks.)
2	FasDllLocalAddr	Sets the local address to specify VCR in EXA. A range of 0x20 to 0xF7 in hexadecimal.
3	FasDllConfigured RemoteAddr	Sets the node address of the called party for communication and the address (DLSAP or DLCEP) used to specify VCR in that address. For DLSAP or DLCEP, a range of 0x20 to 0xF7 in hexadecimal is used. Addresses in Subindex 2 and 3 need to be set to the same contents of the VCR as the called party (local and remote are reversed).
4	FasDllSDAP	Specifies the quality of communication. Usually, one of the following types is set. 0x2B: Server 0x01: Source (Alert) 0x03: Source (Trend) 0x91: Publisher
5	FasDllMaxConfirm DelayOnConnect	To establish connection for communication, a maximum wait time for the called party's response is set in ms. Typical value is 60 seconds (60000).
6	FasDllMaxConfirm DelayOnData	For request of data, a maximum wait time for the called party's response is set in ms. Typical value is 60 seconds (60000).
7	FasDllMaxDlsduSize	Specifies maximum DL Service Data unit Size (DLSDU). Set 256 for Server and Trend VCR, and 64 for other VCRs.
8	FasDllResidual ActivitySupported	Specifies whether connection is monitored. Set TRUE (0xff) for Server. This parameter is not used for other communication.
9	FasDllTimeliness Class	Not used.
10	FasDllPublisherTime WindowSize	Not used.
11	FasDllPublisher SynchronizaingDlcep	Not used.
12	FasDllSubsriberTime WindowSize	Not used.
13	FasDllSubscriber SynchronizationDlcep	Not used.
14	FmsVfdId	Sets VFD for EXA to be used. 0x1: System/network management VFD 0x1234: Function block VFD
15	FmsMaxOutstanding ServiceCalling	Set 0 to Server. It is not used for other applications.
16	FmsMaxOutstanding ServiceCalled	Set 1 to Server. It is not used for other applications.
17	FmsFeatures Supported	Indicates the type of services in the application layer. In the EXA, it is automatically set according specific applications.

33 VCRs are factory-set as shown in the table 3.6.

Table 3.6 VCR List

Index (SM)	VCR Number	Factory Setting
293	1	For system management (Fixed)
294	2	Server (LocalAddr = 0xF3)
295	3	Server (LocalAddr = 0xF4)
296	4	Server (LocalAddr = 0xF7)
297	5	Trend Source (LocalAddr = 0x07, Remote Address=0x111)
298	6	Publisher for AI1 (LocalAddr = 0x20)
299	7	Alert Source (LocalAddr = 0x07, Remote Address=0x110)
300	8	Server (LocalAddr = 0xF9)
301 to 325	9 to 33	Not set

3-3-5-2 Function Block Execution Control

According to the instructions given in Section 3-3-3, set the execution cycle of the function blocks and schedule of execution.

3-3-6 Block Setting

Set the parameter for function block VFD.

3-3-6-1 Link Object

Link object combines the data voluntarily sent by the function block with VCR. The EXA has 40 link objects. A single link object specifies one combination. Each link object has the parameters listed in Table 3.7. Parameters must be changed together for each VCR because the modifications made to each parameter may cause inconsistent operation.

Table 3.7 Link Object Parameters

Sub-index	Parameters	Description
1	LocalIndex	Sets the index of function block parameters to be combined; set “0” for Trend and Alert.
2	VcrNumber	Sets the index of VCR to be combined. If set to “0”, this link object is not used.
3	RemoteIndex	Not used in EXA. Set to “0”.
4	ServiceOperation	Set one of the following. Only one link object is used for Alert and/or Trend. 0: Undefined 2: Publisher 6: Alert 7: Trend
5	StaleCountLimit	Set the maximum number of consecutive stale input values which may be received before the input status is set to BAD. To avoid the unnecessary mode transition caused when the data is not correctly received by subscriber, set this parameter to “2” or more.

Set link objects as shown in Table 3.8.

Table 3.8 Factory-Settings of Link Objects (example)

Index	Link Object#	Factory Settings
30000	1	AI1.OUT ⟶ VCR#6
30001	2	Trend ⟶ VCR#5
30002	3	Alert ⟶ VCR#7
30003 to 30039	4 to 40	Not used

3-3-6-2 Trend Object

It is possible to set the parameter so that the function block automatically transmits Trend. The EXA has ten Trend objects: eight for trends of analog paramenters and two for discrete parameters. A single Trend object specifies the trend of one parameter.

Each Trend object has the parameters listed in Table 3.9. The first four parameters are the items to be set. Before writing to a Trend object, it is necessary to release the WRITE_LOCK parameter.

Table 3.9 Parameters for Trend Objects

Sub-index	Parameters	Description
1	Block Index	Sets the leading index of the function block that takes a trend.
2	Parameter Relative Index	Sets the index of parameters taking a trend by a value relative to the beginning of the function block. In the EXA AI block, the following three types of trends are possible. 7: PV 8: OUT 19: FIELD_VAL
3	Sample Type	Specifies how trends are taken. Choose one of the following 2 types: 1:Sampled upon execution of a function block. 2:The average value is sampled.
4	Sample Interval	Specifies sampling intervals in units of 1/32 ms. Set the integer multiple of the function block execution cycle.
5	Last Update	The last sampling time.
6 to 21	List of Status	16 samples of status.
21 to 37	List of Samples	16 samples of data.

Ten trend objects are factory-set as shown Table 3.10.

Table 3.10 Trend Object are Factory-Set

Index	Parameters	Factory Settings
32000 to 32007	TREND_FLT.1 to TREND_FLT.8	Not used.
32008 to 32009	TREND_DIS.1 to TREND_DIS.2	Not used.

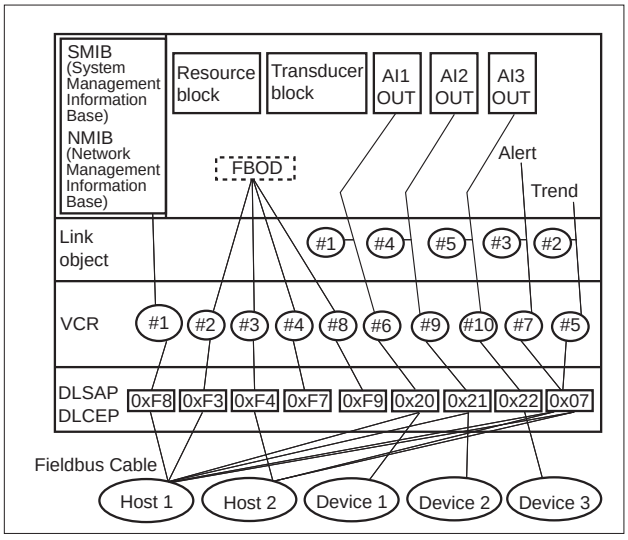


Figure 3.10 Example of Default Configuration

3-3-6-3 View Object

This is the object to form groups of parameters in a block. One advantage of forming groups of parameters is the reduction of load for data transaction. The EXA has four View Objects for each Resource block, Transducer block and AI1, AI2, AI3 function block, and each View Object has the parameters listed in Table 3.12 to 3.14.

Table 3.11 Purpose of Each View Object

	Description
VIEW_1	Set of dynamic parameters required by operator for plant operation. (PV, SV, OUT, Mode etc.)
VIEW_2	Set of static parameters which need to be shown to plant operator at once. (Range etc.)
VIEW_3	Set of all the dynamic parameters
VIEW_4	Set of static parameters for configuration or maintenance.

Table 3.12 Indexes of View for Each Block

	VIEW_1	**VIEW_2**	**VIEW_3**	**VIEW_4**
Resource Block	40100	40101	40102	40103
Transducer Block	40200	40201	40202	40203
AI1 Function Block	40400	40401	40402	40403
AI2 Function Block	40410	40411	40412	40413
AI3 Function Block	40420	40421	40422	40423

Table 3.13 View Object for Resource Block

Relative Index	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	RS_STATE	1		1	
8	TEST_RW				
9	DD_RESOURCE				
10	MANUFAC_ID				4
11	DEV_TYPE				2
12	DEV_REV				1
13	DD_REV				1
14	GRANT_DENY		2		
15	HARD_TYPES				2
16	RESTART				
17	FEATURES				2
18	FEATURE_SEL		2		
19	CYCLE_TYPE				2
20	CYCLE_SEL		2		
21	MIN_CYCLE_T				4
22	MEMORY_SIZE				2
23	NV_CYCLE_T		4		
24	FREE_SPACE		4		
25	FREE_TIME	4		4	
26	SHED_RCAS		4		
27	SHED_ROUT		4		
28	FAULT_STATE	1		1	
29	SET_FSTATE				
30	CLR_FSTATE				
31	MAX_NOTIFY				1
32	LIM_NOTIFY		1		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				
36	BLOCK_ALM				
37	ALARM_SUM	8		8	
38	ACK_OPTION 2				2
39	WRITE_PRI				
40	WRITE_ALM				
41	ITK_VER				2
42	SOFT_REV				
43	SOFT_DESC				
44	SIM_ENABLE_MSG				
45	DEVICE_STATUS_1			4	
46	DEVICE_STATUS_2			4	
47	DEVICE_STATUS_3			4	
48	DEVICE_STATUS_4			4	

Table 3.13 View Object for Resource Block (contineous)

Relative Index	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3	VIEW 4
49	DEVICE_STATUS_5			4	
50	DEVICE_STATUS_6			4	
51	DEVICE_STATUS_7			4	
52	DEVICE_STATUS_8			4	
53	SOFTDWN_PROTECT				1
54	SOFTDWN_FORMAT				1
55	SOFTDWN_COUNT				2
56	SOFTDWN_ACT_AREA			1	
57	SOFTDWN_MOD_REV			16	
58	SOFTDWN_ERROR			2	
	TOTALS (# BYTES)	22	30	73	35

Table 3.14 View Object for AI1.AI2.AI3 Function Block

Relative Index	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	OUT	5		5	
9	SIMULATE				
10	XD_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	IO_OPTS				2
14	STATUS_OPTS				2
15	CHANNEL				2
16	L_TYPE				1
17	LOW_CUT				4
18	PV_FTIME				4
19	FIELD_VAL	5		5	
20	UPDATE_EVT				
21	BLOCK_ALM				
22	ALARM_SUM	8		8	
23	ACK_OPTION				2
24	ALARM_HYS				4
25	HI_HI_PRI				1
26	HI_HI_LIM				4
27	HI_PRI				1
28	HI_LIM				4
29	LO_PRI				1
30	LO_LIM				4
31	LO_LO_PRI				1
32	LO_LO_LIM				4
33	HI_HI_ALM				
34	HI_ALM				
35	LO_ALM				
36	LO_LO_ALM				
	TOTALS (# BYTES)	31	26	31	46

Table 3.15 View Object for Transducer Block PH202

Relative Index	PARAMETER NAME	VIEW _1	VIEW _2	VIEW _3	VIEW _4
0	BLOCK HEADER				
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	UPDATE_EVT				
8	BLOCK_ALM				
9	TRANSDUCER_ DIRECTORY				
10	TRANSDUCER_TYPE	2	2	2	2
11	XD_ERROR	1		1	
12	COLLECTION_ DIRECTORY				
13	PRIMARY_VALUE_TYPE		2		
14	PRIMARY_VALUE	5		5	
15	PRIMARY_VALUE_ RANGE				11
16	SENSOR_TYPE_PH				
17	SENSOR_MV				
18	CAL_POINT_HI		4		
19	CAL_POINT_LO		4		
20	CAL_MIN_SPAN				4
21	SLOPE				4
22	SLOPE_UNIT				2
23	ZERO				4
24	ZERO_UNIT				2
25	ISOPOTENTIAL_PH				4
26	SENSOR_CAL_METHOD				1
27	SENSOR_CAL_DATE				8
28	SECONDARY_VALUE	5		5	
29	SECONDARY_ VALUE_UNIT		2		
30	SENSOR_TEMP_COMP				1
31	SENSOR_TEMP_ MAN_VALUE				4
32	SENSOR_TYPE_TEMP				2
33	SENSOR_ CONNECTION_TEMP				1
34	TERTIARY_VALUE_TYPE		2		
35	TERTIARY_VALUE	5		5	
36	TERTIARY_VALUE_ RANGE				11
37	TERTIARY_ZERO				4
38	GLASS_IMPEDANCE			4	
39	REFERENCE_ IMPEDANCE			4	
40	ALARM_SUM	8		8	
41	DEV_ALARM	4		4	
42	LOGBOOK1_RESET				
43	LOGBOOK1_EVENT				
44	LOGBOOK2_RESET				
45	LOGBOOK2_EVENT				
46	LOGBOOK_CONFIG				23
47	TEST_1				
48-59	TEST_2 ... TEST_13				
60	STABLE_TIME				
61	STABLE_VALUE				
62	CALL_MAINT_TIME_ COUNTD.			1	
63	CALL_MAINT_TIME_ RELOAD				1
64	INPUT_1_ IMPEDANCE_LO_LIM				4
65	INPUT_1_ IMPEDANCE_HI_LIM				4

Table 3.15 View Object for Transducer Block PH202 (contineous)

Relative Index	PARAMETER NAME	VIEW _1	VIEW _2	VIEW _3	VIEW _4
66	INPUT_2_ IMPEDANCE_LO_LIM				4
67	INPUT_2_ IMPEDANCE_HI_LIM				4
68	BUFFER1_ID				
69	BUFFER1				
70	BUFFER2_ID				
71	BUFFER2				
72	BUFFER3_ID				
73	BUFFER3				
74	TEMPERATURE_ COEFFICIENT				
75	PASSCODE_ MAINTENANCE				
76	PASSCODE_ COMMISSIONING				
77	PASSCODE_SERVICE				
78	SAMPLE_PV			4	
79	SAMPLE_PV2			4	
80	SAMPLE_TEMP			4	
81	ERROR_CONFIG				4
82	CONFIGURATION				4
83	TRANSMITTER_TIME			6	
84	SOFTDWN_TEST				1
	TOTALS (# BYTES)	38	18	65	119

Table 3.16 View Object for Transducer Block SC202/ISC202

Realtive Index	Parameters Mnemonic	View 1	View 2	View 3	View 4
0	BLK_DATA				
1	ST_REV	2	2	2	2
2	TAG_DESC[32]				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	UPDATE_EVT				
8	BLOCK_ALM				
9	TRANSDUCER_ DIRECTORY[2]				
10	TRANSDUCER_TYPE	2	2	2	2
11	XD_ERROR	1		1	
12	COLLECTION_ DIRECTORY[7]				
13	PRIMARY_VALUE_ TYPE		2		
14	PRIMARY_VALUE	5		5	
15	PRIMARY_VALUE_ RANGE				11
16	SENSOR_CONST				4
17	CAL_POINT_HI		4		
18	CAL_POINT_LO		4		
19	CAL_MIN_SPAN				4
20	SENSOR_CAL_ METHOD				1
21	SENSOR_CAL_DATE				8
22	SECONDARY_VALUE	5		5	
23	SECONDARY_VALUE_ UNIT		2		
24	SENSOR_TEMP_COMP				1
25	SENSOR_TEMP_MAN_ VALUE				
26	SENSOR_TYPE_TEMP				2
27	SENSOR_CONNECTION_ TEMP				1
28	SENSOR_TYPE_COND				2
29	SENSOR_OHMS				

Table 3.16 View Object for Transducer Block SC202/ISC202 (contineous)

Realtive Index	Parameters Mnemonic	View 1	View 2	View 3	View 4
30	XD_MAN_ID[32]				
31	TEMPERATURE_ COEFF				4
32	CONCENTRATION	5		5	
33	TERTIARY_VALUE	5		5	
34	REFERENCE_ TEMPERATURE				4
35	COMP_METHOD		1		1
36	COMP_MATRIX_SEL				1
37	TERTIARY_COMP_ METHOD				1
38	TERT_TEMPERATURE_ COEFF				4
39	ALARM_SUM	8		8	
40	DEV_ALARM	4		4	
41	LOGBOOK1_RESET				
42	LOGBOOK1_EVENT				
43	LOGBOOK2_RESET				
44	LOGBOOK2_EVENT				
45	LOGBOOK_CONFIG[16]				16
46	TEST_1				
58	TEST_13				
59	CALIB_SENSOR_ CONST			4	
60	MATRIX_TEMP_RANGE				
61	SOLUTION_1				
62	SOLUTION_2				
63	SOLUTION_3				
64	SOLUTION_4				
65	SOLUTION_5				
66	CONCENTRATION_ MEASUREMENT				1
67	CONCENTRATION_0				
68	CONCENTRATION_100				
69	CONCENTRATION_ TABLE_LOW				
70	CONCENTRATION_ TABLE_MID				
71	CONCENTRATION_ TABLE_HIGH				
72	E5_LIMIT				4
73	E6_LIMIT				4
74	DISPLAY_RESOLUTION			1	
75	PASSCODE_ MAINTENANCE				2
76	PASSCODE_ COMMISSIONING				2
77	PASSCODE_SERVICE				2
78	ERROR_CONFIG				4
79	CONFIGURATION				4
80	TRANSMITTER_TIME			6	
81	SOFTDWN_TEST				1
	TOTALS (# BYTES)	43	17	54	96

Table 3.17 View Object for Transducer Block DO202

Realtive Index	Parameters Mnemonic	View 1	View 2	View 3	View 4
0	BLK_DATA				
1	ST_REV	2	2	2	2
2	TAG_DESC[32]				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	UPDATE_EVT				
8	BLOCK_ALM				

Table 3.17 View Object for Transducer Block DO202 (continues)

Realtive Index	Parameters Mnemonic	View 1	View 2	View 3	View 4
9	TRANSDUCER_ DIRECTORY[2]				
10	TRANSDUCER_TYPE	2	2	2	2
11	XD_ERROR	1		1	
12	COLLECTION_ DIRECTORY[7]				
13	PRIMARY_VALUE_TYPE		2		
14	PRIMARY_VALUE	5		5	
15	PRIMARY_VALUE_ RANGE				11
16	PRIMARY_VALUE_UNIT		2		
17	SENSOR_TYPE_OXYGEN				2
18	SAMPLE_CAL				
19	ZERO_CURRENT				4
20	SENSITIVITY				4
21	AMP_STABILIZE_TIME				4
22	AMP_SPAN_ STABILIZE _VALUE				4
23	AMP_ZERO_ STABILIZE_VALUE				4
24	SALINITY				4
25	BAR_PRESSURE				4
26	BAR_PRESSURE_UNIT		2		
27	PERCENT_SATURATION_ PRESSURE				4
28	CHLORINE_ CALIBRATION_RANGES				
29	SECONDARY_VALUE	5		5	
30	SECONDARY_ VALUE_UNIT		2		
31	SENSOR_TEMP_COMP				1
32	SENSOR_TEMP_ MAN_VALUE				4
33	SENSOR_TYPE_TEMP				2
34	TEMP_SENSOR_CAL				4
35	SENSOR_CURRENT	5		5	
36	PERCENT_SATURATION	5		5	
37	ZERO_CURRENT_LIMIT				4
38	ZERO_CAL				
39	RESERVED1				
40	RESERVED2				
41	RESERVED3				
42	TRANSMITTER_TIME[6]			6	
43	PASSCODE_ MAINTENANCE				
44	PASSCODE_ COMMISSIONING				
45	PASSCODE_SERVICE				
46	LOGBOOK1_RESET				
47	LOGBOOK1_EVENT				
48	LOGBOOK2_RESET				
49	LOGBOOK2_EVENT				
50	LOGBOOK_CONFIG[25]				25
51	CALL_MAINT_TIME_ RELOAD				1
52	CALL_MAINT_TIME_ COUNTDOWN			1	
53	ERROR_CONFIG				4
54	CONFIGURATION				4
55	ALARM_SUM	8		8	
56	DEV_ALARM	4		4	
57	TEST_1				
69	TEST_13				
70	SOFTDWN_TEST				1
	TOTALS (# BYTES)	43	12	50	102

3-3-6-4 Function Block Parameters

Function block parameters can be read from the host or can be set. For a list of the parameters of blocks held by the EXA, refer to “3-6 List of parameters for each block of the EXA”. The following is a list of important parameters with a guide how to set them.

MODE_BLK:
This mode parameter is very important as it gives the state of the block. In O/S (Out_Of_Service) mode the block is out of operation. In this mode it is allowed to update parameters. Manual mode gives the operator the possibility to manually update a selected number of parameters (values, scaling e.g.) in order to test the system. In automatic mode the function block is executed and block parameters are automatically updated. Under normal operating circumstances, set the Auto mode for normal operation. Auto mode is the factory default.

Note:
The actual mode is changed by setting the target mode. When the resource block mode is set to OOS all function blocks in the VFD are set to OOS mode.

CHANNEL:
Transducer blocks convert raw signals into process values. The values are assigned to channels.
For the EXA 202 three or four channels are available.

PH202
1: pH,
2: Temperature,
3: ORP/rH

Channel	value	unit
1	primary_value	primary_value_range.unit
2	secondary_value	secondary_value_unit
3	tertiary_value	tertiary_value_range.unit

SC202
1: Conductivity/Resistivity,
2: Temperature,
3: Second Conductivity/Resistivity,
4: Concentration

Channel	value	unit
1	primary_value	primary_value_range.units
2	secondary_value	secondary_value_unit
3	tertiary_value	primary_value_range.units
4	concentration	always %

ISC202
1: Conductivity,
2: Temperature,
3: Second Conductivity,
4: Concentration

Channel	value	unit
1	primary_value	primary_value_range.units
2	secondary_value	secondary_value_unit
3	tertiary_value	primary_value_range.units
4	concentration	always %

DO202
1: Dissolved Oxygen,
2: Temperature,
3: Percent Saturation,
4: Sensor Current

Channel	Value	Unit
1	primary_value	primary_value_range.units
2	secondary_value	secondary_value_unit
3	percent_saturation	%
4	sensor_current	nA

XD_SCALE/OUT_SCALE:
Scaling information is used for two purposes. Display devices need to know the range for bar graphs and trending, as well as the units code. Control blocks need to know the range to use internally as percent of span, so that the tuning constants may remain dimensionless. This is converted back to a number with units by using the range of OUT_SCALE. The AI block has the parameter XD_SCALE to define the units expected from the transducer.

Transducer scaling (XD_SCALE) is applied to the value from the channel to produce the FIELD_VAL in percent. The XD_SCALE units code must match the channel units code.
The EXA transmitter does this automatically when the Service Codes are changed. See table 3.18 to 3.21 for the Service codes and their results.
If L_TYPE is set to Indirect or Ind Sqr Root, OUT_SCALE determines the conversion from FIELD_VAL to the output. PV and OUT always have identical scaling. OUT_SCALE provides scaling for PV. The PV is always the value that the block will place in OUT if the mode is Auto.

Table 3.18 Unit Index by XD_SCALE PH202

Channel	FF parameters	Service code	XD_SCALE.UNITS
1	-	SC01 (set to 0)	pH
2	2029	SC11 (set to 0)	ºC
2	2029	SC11 (set to 1)	ºF
3	-	SC01 (set to 1)	mV
3	-	SC01 (set to 0), SC02 (set to 1)	mV
3	-	SC01 (set to 0), SC02 (set to 2)	rH

Table 3.19 Unit Index by XD_SCALE SC202

Channel	FF parameters	Service code	XD_SCALE.UNITS
2	2023	SC11 (set to 0)	°C (1001)
2	2023	SC11 (set to 1)	°F (1002)
1, 3	-	SC01 (set to 1)	Ω•cm (1295)
1, 3	-	SC01 (set to 0)	S/cm (1594)
4	-	Default %	% (1342)

Table 3.20 Unit Index by XD_SCALE ISC202

Channel	FF parameters	Service code	XD_SCALE.UNITS
2	2023	SC11 (set to 0)	°C (1001)
2	2023	SC11 (set to 1)	°F (1002)
1, 3	-	Default S/cm	S/cm (1594)
4	-	Default %	% (1342)

Table 3.21 Unit Index by XD_SCALE DO202

Channel	FF parameters	Service code	XD_SCALE.UNITS
2	FF2030	SC11 (set to 0)	°C (1001)
2	FF2030	SC11 (set to 1)	°F (1002)
1	FF2016	SC56 (set to 0)	ppm (1423)
1	FF2016	SC56 (set to 1)	ppb (1424)
1	FF2016	SC56 (set to 2)	% (1342)
3	-	Default %	% (1342)
4	-	Default nA	nA (1213)

L_TYPE:
Specifies the operation function of the AI block. If set to “Direct”, the input delivered to CHANNEL is directly reflected on OUT. If set to “Indirect”, scaling by XD_SCALE and OUT_SCALE is carried out and is reflected on OUT. If set to “Indirect SQRT”, after scaling by XD_SCALE, the square root is extracted and the value scaled by OUT_SCALE is reflected on OUT.

Example:
Channel range is defined as 0 to 100 °C but °F units is required for HOST display.
Set the following parameters:

XD_SCALE: EU@0% = 0 °C
EU@100% = 100 °C
Unit = °C
Decimal point = 2
OUT_SCALE: EU@0% = 32 °F
EU@100% = 212 °F
Unit = °F
Decimal point = 2

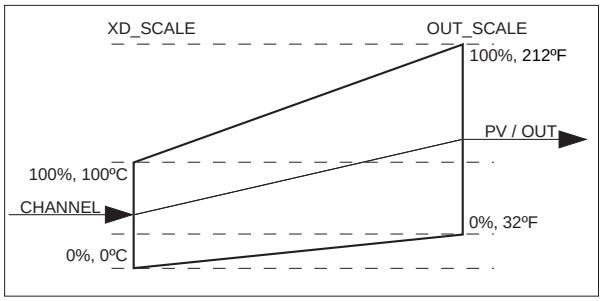


Figure 3.11 Scaling applied to temperature conversion.

PV_FTIME:
Sets the time constant of the damping function within AI block (primary delay) in seconds.

Alarm Priority:
Indicates the priority of the process alarm. If a value of 3 or greater is set, an alarm is transmitted.
The factory default is 0.
Four types of alarm can be set:
HI_PRI, HI_HI_PRI, LO_PRI, and LO_LO_PRI.

Alarm Threshold:
Sets the threshold at which a process alarm is generated. The factory default setting is a value that does not generate an alarm.
Four types of alarm can be set:
HI_LIM, HI_HI_LIM, LO_LIM, and LO_LO_LIM.

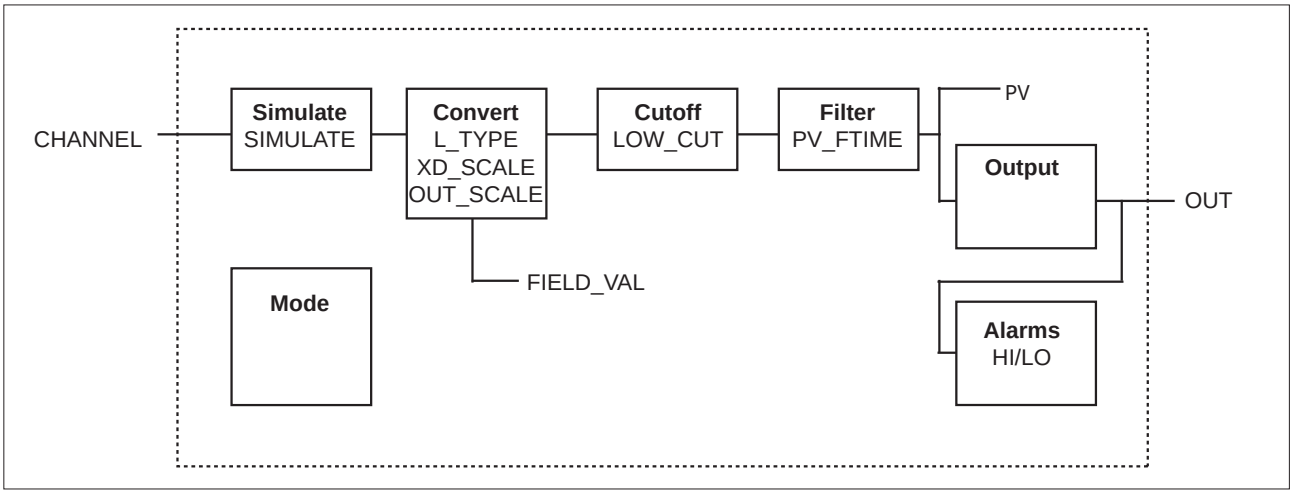
Equations:

$$FIELD\_VAL = 100\,\frac{(\text{channel value} - EU@0\%)}{(EU@100\% - EU@0\%)} \qquad [XD\_SCALE]$$

Direct: PV = channel value

$$\text{Indirect: } PV = EU@0\% + \frac{FIELD\_VAL}{100}(EU@100\% - EU@0\%) \qquad [OUT\_SCALE]$$

$$\text{Ind Sqr Root: } PV = EU@0\% + \frac{\sqrt{(FIELD\_VAL)}}{100}(EU@100\% - EU@0\%) \qquad [OUT\_SCALE]$$



3-4 In-process operation

This chapter describes the procedure performed when changing the operation of the function block of the EXA in process.

3-4-1 Mode Transition

When the function block mode is changed to Out_Of_Service, the function block pauses and a block alarm is issued.

When the function block mode is changed to Manual, the function block suspends updating of output values. In this case alone, it is possible to write a value to the OUT parameter of the block for output. Note that no parameter status can be changed.

3-4-2 Generation of Alarm

3-4-2-1 Indication of Alarm

Figure 3.12 Error Identification on Indicator

3-4-2-2 Alarms and Events

Following alarm or event can be reported by EXA as an alert if allowed.

Analog Alerts
(Generated when a process value exceeds threshold)

By AI1 Block	Hi-Hi Alarm, Hi Alarm, Low Alarm, Low-Low Alarm
By AI2 Block	Hi-Hi Alarm, Hi Alarm, Low Alarm, Low-Low Alarm
By AI3 Block	Hi-Hi Alarm, Hi Alarm, Low Alarm, Low-Low Alarm

Discrets Alerts
(Generated when an abnormal condition is detected)

By Resource Block	Block Alarm, Write Alarm
By Transducer Block	Block Alarm
By AI1 Block	Block Alarm
By AI2 Block	Block Alarm
By AI3 Block	Block Alarm

Update Alerts
(Generated when a important (restorable) parameter is updated)

By Resource Block	Update Event
By Transducer Block	Update Event
By AI1 Block	Update Event
By AI2 Block	Update Event
By AI3 Block	Update Event

An alert has following structure:

Table 3.22 Alert Object

Subindex			Parameter Name	Explanation
Analog Alert	Discrete Alert	Update Alert		
1	1	1	Block Index	Index of block from which alert is generated
2	2	2	Alert Key	Alert Key copied from the block
3	3	3	Standard Type	Type of the alert
4	4	4	Mfr Type	Alert Name identified by manufacturer specific DD
5	5	5	Message Type	Reason of alert notification
6	6	6	Priority	Priority of the alarm
7	7	7	Time Stamp	Time when this alert is first detected
8	8		Subcode	Enumerated cause of this alert
9	9		Value	Value of referenced data
10	10		Relative Index	Relative index of referenced data
		8	Static Revision	Value of static revision (ST_REV) of the block
11	11	9	Unit Index	Unit code of referenced data

3-4-3 Simulation Function

The simulation function simulates the input of a function block and lets it operate as if the data was received from the transducer block. It is possible to conduct testing for the downstream function blocks or alarm processes.

A SIMULATE_ENABLE switch is mounted on the FF PCB assembly. This is to prevent the accidental operation of this function. When this is switched on, simulation is enabled. (See Figure 3.13) To initiate the same action from a remote terminal, if REMOTE LOOP TEST SWITCH is written to the SIM_ENABLE_MSG parameter (index 1044) of the resource block, the resulting action is the same as is taken when the above switch is on. Note that this parameter value is lost when the power is turned OFF. In simulation enabled status, an alarm is generated from the resource block, and other device alarms will be masked; for this reason the simulation must be disabled immediately after using this function.

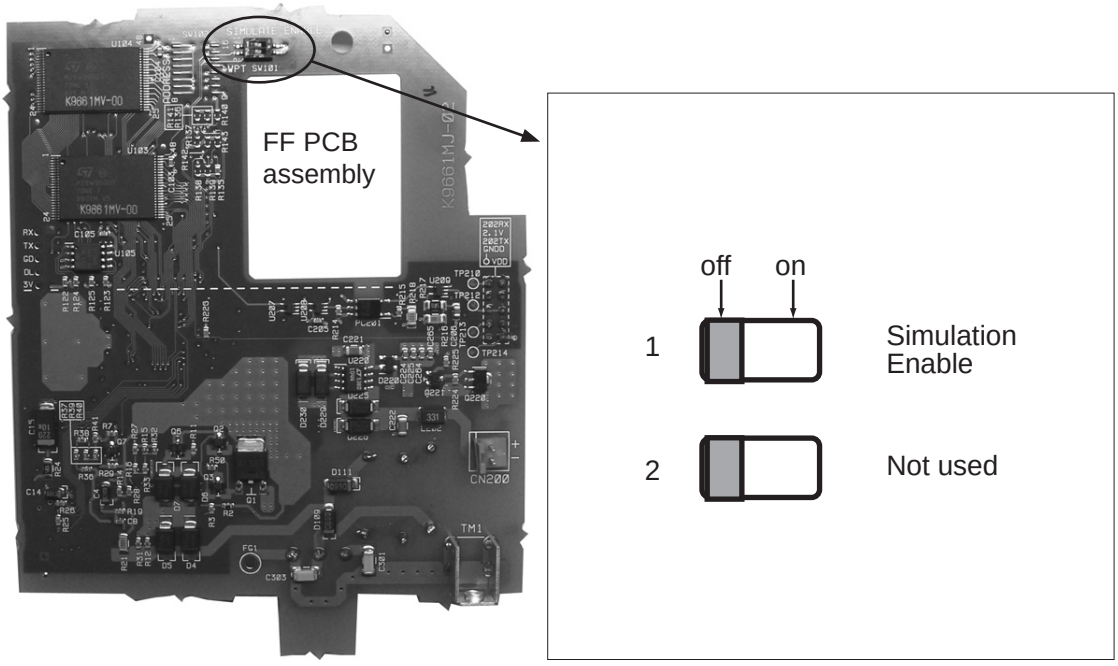


Figure 3.13 SIMULATE_ENABLE Switch Position

The SIMULATE parameter of AI block consists of the elements listed in Table 3.23 below.

Table 3.23 SIMULATE Parameter

Sub-index	Parameters	Description
1	Simulate Status	Sets the data status to be simulated.
2	Simulate Value	Sets the value of the data to be simulated.
3	Transducer Status	Displays the data status from the transducer block. It cannot be changed.
4	Transducer Value	Displays the data value from the transducer block. It cannot be changed.
5	Simulate En/Disable	Controls the simulation function of this block. 1: Simulation disabled (standard) 2: Simulation started

When Simulate En/Disable in Table 3.23 above is set to 2, the applicable function block uses the simulation value set in this parameter instead of the data from the transducer block. This setting can be used for propagation of the status to the trailing blocks, generation of a process alarm, and as an operation test for trailing blocks.

3-5 Device status

Device setting status and failures of EXA are indicated by using parameter DEVICE_STATUS_1, DEVICE_STATUS_2 and DEVICE_STATUS_3 (index 1045, 1046 and 1047) in Resource Block.

Table 3.24 Contents of DEVICE_STATUS_1, DEVICE_STATUS_2 and DEVICE_STATUS_3

DEVICE_STATUS_1 Hexadecimal Display through DD	DEVICE_STATUS_3 Hexadecimal Display through DD
0x80000000	0x80000000
0x40000000	0x40000000
0x20000000	0x20000000
0x10000000	0x10000000
0x08000000	0x08000000 Transducer Block is in O/S mode
0x04000000	0x04000000
0x02000000	0x02000000
0x01000000	0x01000000
0x00800000 Sim.enable Jmpr On	0x00800000
0x00400000 RB in O/S mode	0x00400000
0x00200000	0x00200000
0x00100000	0x00100000
0x00080000 Fbus EEPROM error	0x00080000
0x00040000	0x00040000
0x00020000	0x00020000 Simulation is enabled in AI3 Function Block
0x00010000	0x00010000 AI3 Function Block is in Manual mode
0x00008000 Link Obj.1 not open	0x00008000 AI3 Function Block is inO/S mode
0x00004000 Link Obj.2 not open	0x00004000 Simulation is enabled in AI2 Function Block
0x00002000 Link Obj.3 not open	0x00002000 AI2 Function Block is in Manual mode
0x00001000 Link Obj.4 not open	0x00001000 AI2 Function Block is in O/S mode
0x00000800 Link Obj.5 not open	0x00000800 AI1 Function Block is not scheduled
0x00000400 Link Obj.6 not open	0x00000400 Simulation is enabled in AI1 Function Block
0x00000200 Link Obj.7 not open	0x00000200 AI1 Function Block is in Manual mode
0x00000100 Link Obj.8 not open	0x00000100 AI1 Function Block is in O/S mode
0x00000080 Link Obj.9 not open	0x00000080
0x00000040 Link Obj.10 not open	0x00000040
0x00000020 Link Obj.11 not open	0x00000020
0x00000010 Link Obj.12 not open	0x00000010
0x00000008 Link Obj.13 not open	0x00000008
0x00000004 Link Obj.14 not open	0x00000004
0x00000002 Link Obj.15 not open	0x00000002
0x00000001 Link Obj.16 not open	0x00000001

DEVICE_STATUS_2 PH202	
Hexadecimal	**Display through DD**
0x80000000	
0x40000000	
0x20000000	
0x10000000	
0x08000000	
0x04000000	
0x02000000	
0x01000000	
0x00800000	
0x00400000	
0x00200000	
0x00100000	
0x00080000	FF interface checksum error
0x00040000	EXA checksum error (E21)
0x00020000	Internal communication failure
0x00010000	FF interface eeprom failure
0x00008000	EXA eeprom failure (E20)
0x00004000	mismatch between FF- and EXA parameter
0x00002000	
0x00001000	
0x00000800	
0x00000400	
0x00000200	
0x00000100	calibration timer expired (E16)
0x00000080	reference impedance exceeds low limit (E4.2)
0x00000040	reference impedance exceeds high limit (E5.2)
0x00000020	glass impedance exceeds low limit (E4.1)
0x00000010	glass impedance exceeds high limit (E5.1)
0x00000008	temperature sensor shorted (E8)
0x00000004	temperature sensor open (E7)
0x00000002	tertiary value exceeds limits (E12)
0x00000001	primary value exceeds limits (E9)

DEVICE_STATUS_2 SC202	
Hexadecimal	**Display through DD**
0x80000000	
0x40000000	
0x20000000	
0x10000000	
0x08000000	
0x04000000	
0x02000000	
0x01000000	
0x00800000	
0x00400000	
0x00200000	
0x00100000	
0x00080000	FF interface checksum error
0x00040000	EXA checksum error (E21)
0x00020000	Hart communication failure
0x00010000	FF interface eeprom failure
0x00008000	EXA eeprom failure (E20)
0x00004000	mismatch between FF- and EXA parameter
0x00002000	
0x00001000	
0x00000800	
0x00000400	
0x00000200	
0x00000100	matrix error (E4)
0x00000080	concentration table error (E18)
0x00000040	conductivity exceeds usp limit (E13)
0x00000020	polarization detected (E1)
0x00000010	temperature compensation error (E2)
0x00000008	temperature sensor shorted (E8)
0x00000004	temperature sensor open (E7)
0x00000002	conductivity exceeds low limit (E6)
0x00000001	conductivity exceeds high limit (E5)

DEVICE_STATUS_2 ISC202	
Hexadecimal	**Display through DD**
0x80000000	
0x40000000	
0x20000000	
0x10000000	
0x08000000	
0x04000000	
0x02000000	
0x01000000	
0x00800000	
0x00400000	
0x00200000	
0x00100000	
0x00080000	FF interface checksum error
0x00040000	EXA checksum error (E21)
0x00020000	Hart communication failure
0x00010000	FF interface eeprom failure
0x00008000	EXA eeprom failure (E20)
0x00004000	mismatch between FF- and EXA parameter
0x00002000	
0x00001000	
0x00000800	
0x00000400	
0x00000200	
0x00000100	matrix error (E4)
0x00000080	concentration table error (E18)
0x00000010	temperature compensation error (E2)
0x00000008	temperature sensor shorted (E8)
0x00000004	temperature sensor open (E7)
0x00000002	conductivity exceeds low limit (E6)
0x00000001	conductivity exceeds high limit (E5)

DEVICE_STATUS_2 DO202	
Hexadecimal	**Display through DD**
0x80000000	
0x40000000	
0x20000000	
0x10000000	
0x08000000	
0x04000000	
0x02000000	
0x01000000	
0x00800000	
0x00400000	
0x00200000	
0x00100000	
0x00080000	FF interface checksum error
0x00040000	EXA checksum error (E21)
0x00020000	Internal communication failure
0x00010000	FF interface eeprom failure
0x00008000	EXA eeprom failure (E20)
0x00004000	mismatch between FF- and EXA parameter
0x00002000	
0x00001000	
0x00000800	
0x00000400	
0x00000200	
0x00000100	
0x00000080	
0x00000040	Call for maintenance (E16)
0x00000020	Sensor current abnormal (E9)
0x00000010	temperature sensor shorted (E8)
0x00000008	temperature sensor open (E7)
0x00000004	
0x00000002	Zero out of limits (E2)
0x00000001	

3-6 List of parameters for each block of the EXA

Note: The Write Mode column contains the modes in which each parameter is write enabled.
O/S: Write enabled in O/S mode.
MAN: Write enabled in Man mode and O/S mode.
AUTO: Write enabled in Auto mode, Man mode, and O/S mode.

3-6-1 Resource Block

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
0	1000	Block Header	TAG:"RS"	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	1001	ST_REV	–	–	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter alue in this block is changed.
2	1002	TAG_DESC	Null	AUTO	The user description of the intended application of the block.
3	1003	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	1004	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	1005	MODE_BLK	AUTO	AUTO	The actual, target, permitted, and normal modes of the block.
6	1006	BLOCK_ERR	–	–	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	1007	RS_STATE	–	–	State of the resource block state machine.
8	1008	TEST_RW	–	AUTO	Read/write test parameter-used only for conformance testing and simulation.
9	1009	DD_ RESOURCE	Null	–	String identifying the tag of the resource which contains the Device Description for this resource.
10	1010	MANUFAC_ID	0x00594543	–	Manufacturer identification number-used by an interface device to locate the DD file for the resource.
11	1011	DEV_TYPE	PH202: 0x0830 SC202: 0x0831 ISC202: 0x0832 DO202: 0x0833	–	Manufacturer's model number associated with the resource-used by interface devices to locate the DD file for the resource.
12	1012	DEV_REV	3	–	Manufacturer revision number associated with the resource-used by an interface device to locate the DD file for the resource.
13	1013	DD_REV	1	–	Revision of the DD associated with the resource-used by an interface device to locate the DD file for the resource.
14	1014	GRANT_DENY	0	AUTO	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.
15	1015	HARD_TYPES	Scalar input	–	The types of hardware available as channel numbers. bit0: Scalar input bit1: Scalar output bit2: Discrete input bit3: Discrete output
16	1016	RESTART	–	–	Allows a manual restart to be initiated. Several degrees of restart are possible. They are 1: Run, 2: Restart resource, 3: Restart with initial value specified in FF functional spec. (*1), and 4: Restart processor. *1: FF-891 Foundation TM Specification Function Block Application Process Part 2.
17	1017	FEATURES	Soft write lock supported Report supported	–	Used to show supported resource block options.
18	1018	FEATURE_SEL	Soft write lock supported Report supported	AUTO	Used to select resource block options defined in FEATURES. bit0: Scheduled bit1: Event driven bit2: Manufacturer specified
19	1019	CYCLE_TYPE	Scheduled	–	Identifies the block execution methods available for this resource.
20	1020	CYCLE_SEL	Scheduled	AUTO	Used to select the block execution method for this resource.
21	1021	MIN_CYCLE_T	3200 (100ms)	–	Time duration of the shortest cycle interval of which the resource is capable.
22	1022	MEMORY_SIZE	0	–	Available configuration memory in the empty resource. To be checked before attempting a download.
23	1023	NV_CYCLE_T	0	–	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.
24	1024	FREE_SPACE	0	–	Percent of memory available for further configuration. EXA has zero which means a preconfigured resource.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
25	1025	FREE_TIME	0	–	Percent of the block processing time that is free to process additional blocks. EXA does not support this.
26	1026	SHED_RCAS	640000 (2S)	AUTO	Time duration at which to give up on computer writes to function block RCas locations. Supported only with PID function.
27	1027	SHED_ROUT	640000 (2S)	AUTO	Time duration at which to give up on computer writes to function block ROut locations. Supported only with PID function.
28	1028	FAULT_STATE	1	–	Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When fail-safe condition is set, Then output function blocks will perform their FSAFE actions.
29	1029	SET_FSTATE	1	AUTO	Allows the fail-safe condition to be manually initiated by selecting Set.
30	1030	CLR_FSTATE	1	AUTO	Writing a Clear to this parameter will clear the device fail-safe state if the field condition, if any, has cleared.
31	1031	MAX_NOTIFY	3	–	Maximum number of unconfirmed notify messages possible.
32	1032	LIM_NOTIFY	3	AUTO	Maximum number of unconfirmed alert notify messages allowed.
33	1033	CONFIRM_TIM	640000 (2S)	AUTO	The minimum time between retries of alert reports.
34	1034	WRITE_LOCK	Not locked	AUTO	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated
35	1035	UPDATE_EVT	–	–	This alert is generated by any change to the static data.
36	1036	BLOCK_ALM	–	–	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
37	1037	ALARM_SUM	Enable	–	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
38	1038	ACK_OPTION	0xFFFF	AUTO	
39	1039	WRITE_PRI	0	AUTO	Priority of the alarm generated by clearing the write lock.
40	1040	WRITE_ALM	–	–	This alert is generated if the write lock parameter is cleared.
41	1041	ITK_VER	4	–	Version number of interoperability test by Fieldbus Foundation applied to EXA.
42	1042	SOFT_REV		–	EXA software revision number.
43	1043	SOFT_DESC		–	Yokogawa internal use.
44	1044	SIM_ENABLE_ MSG	Null	AUTO	Software switch for simulation function.
45	1045	DEVICE_ STATUS_1	0	–	Device status (VCR setting etc.)
46	1046	DEVICE_ STATUS_2	0	–	Device status (failure or setting error etc.)
47	1047	DEVICE_ STATUS_3	0	–	Device status (function block setting.)
48	1048	DEVICE_ STATUS_4	0	–	Not used.
49	1049	DEVICE_ STATUS_5	0	–	Not used.
50	1050	DEVICE_ STATUS_6	0	–	Not used.
51	1051	DEVICE_ STATUS_7	0	–	Not used.
52	1052	DEVICE_ STATUS_8	0	–	Not used.
53	1053	SOFTDWN_ PROTECT	1	–	Not used.
54	1054	SOFTDWN_ FORMAT	1	–	Not used.
55	1055	SOFTDWN_ COUNT	0	–	Not used.
56	1056	SOFTDWN_ ACT_AREA	0	–	Not used.
57	1057	SOFTDWN_ MOD_REV	1, 0, 0, 0, 0, 0, 0, 0, 0	–	Not used.
58	1058	SOFTDWN_ ERROR	0	–	Not used.

3-6-2 Analog input Block

Relative Index	Parameter Name	Factory Default	Write Mode	Explanation
0	Block Header	TAG: “AI1” or “AI2” or “AI3”	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	ST_REV	–	–	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	TAG_DESC	(blank)	AUTO	The user description of the intended application of the block.
3	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	AUTO	AUTO	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	–	–	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	PV	–	–	Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block.
8	OUT	–	Value= MAN	The primary analog value calculated as a result of executing the function.
9	SIMULATE	Disable	AUTO	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status.
10	XD_SCALE	–	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel. Refer to Table 3.18 to 3.21 for the unit available.
11	OUT_SCALE	–	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.
12	GRANT_DENY	0	AUTO	Options for controlling access of host computers and local control panels to operating, tuning and alarm parameters of the block.
13	IO_OPTS	0	O/S	Options which the user may select to alter input and output block processing bit6: Low cutoff
14	STATUS_OPTS	Propagate Fault Forward	O/S	Options which the user may select in the block processing of status
15	CHANNEL	AI1: 1 AI2: 2 AI3: 3	O/S	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
16	L_TYPE	Direct (1)	MAN	Deterines if the values passed by the transducer time of order block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect), or with square root (Ind Sqr Root), using the input range defined by the transducer and the associated output range.
17	LOW_CUT	Linear: 0%	AUTO	Sets low cut point of output. This low cut value become available by setting “Low cutoff“ to “IO_OPTS“.
18	PV_FTIME	2sec	AUTO	Time constant of a single exponential filter for the PV, in seconds.
19	FIELD_VAL	–	–	Raw value of the field device in percent of thePV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_FTIME).
20	UPDATE_EVT	–	–	This alert is generated by any change to the static data.
21	BLOCK_ALM	–	–	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.

Relative Index	Parameter Name	Factory Default	Write Mode	Explanation
22	ALARM_SUM	–	–	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
23	ACK_OPTION	0xFFFF	AUTO	Selection of whether alarms associated with the block will be automatically acknowledged.
24	ALARM_HYS	0.5%	AUTO	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm Hysteresis is expressed as a percent of the PV span.
25	HI_HI_PRI	0	AUTO	Priority of the high high alarm.
26	HI_HI_LIM	+INF	AUTO	The setting for high high alarm in engineering units.
27	HI_PRI	0	AUTO	Priority of the high alarm.
28	HI_LIM	+INF	AUTO	The setting for high alarm in engineering units.
29	LO_PRI	0	AUTO	Priority of the low alarm.
30	LO_LIM	-INF	AUTO	The setting for the low alarm in engineering units.
31	LO_LO_PRI	0	AUTO	Priority of the low low alarm.
32	LO_LO_LIM	-INF	AUTO	The setting of the low low alarm in engineering units.
33	HI_HI_ALM	–	–	The status for high high alarm and its associated time stamp.
34	HI_ALM	–	–	The status for high alarm and its associated time stamp.
35	LO_ALM	–	–	The status of the low alarm and its associated time stamp.
36	LO_LO_ALM	–	–	The status of the low low alarm and its associated time stamp.

3-6-3 Transducer Block

3-6-3-1 Transducer Block PH202

Index	Parameter name	Factory Default	Valid Range	Description
2000	BLOCK HEADER	TAG: “TB”		General information about the function block
2001	ST_REV	-	-	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2002	TAG_DESC	“ “		The user description of the intended application of the block.
2003	STRATEGY	1		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
2004	ALERT_KEY	1		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
2005	MODE_BLK	AUTO		The actual, target, permitted, and normal modes of the block
2006	BLOCK_ERR	-		This parameter reflects the error status associated with a block. It is a bit-string, so that multiple errors can be shown.
2007	UPDATE_EVT	-		The alert is generated by any change to the static data.
2008	BLOCK_ALM	-		The block alarm is used for all configuration error, hardware connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set Active status in Status attribute.
2009	TRANSDUCER_DIRECTORY			A directory that specifies the number and starting indices of the transducers.
2010	TRANSDUCER_TYPE	Standard pH/ORP		PH, ORP transducer block.
2011	XD_ERROR	-		The error code in transducer: - No failure, - Electronics failure, - I/O failure, - Mechanical failure
2012	COLLECTION_DIRECTORY	-		A directory that specifies the number, starting indices and DD item IDs of the data collection in each transducer within a transducer block.
2013	PRIMARY_VALUE_TYPE	PH	pH, None	Type of measurement represented by primary value.
2014	PRIMARY_VALUE	-	-2 to 16	Primary value of the instrument is pH.
2015	PRIMARY_VALUE_RANGE	-2.00 to 16.00	-2 to 16	The pH range of the instrument. (can not change)
2016	SENSOR_TYPE_PH	pH/ORP sensor	pH/ORP sensor	PH is measured with a glass- and a reference electrode. Redox is measured with a metal- and a reference electrode. When a glass, metal and ref. Electrode are combined one can measure pH and Redox simultaneously.
2017	SENSOR_MV	-	-	The output of the electrode in mV
2018	CAL_POINT_HI	16	-2 to 16	Highest calibration point
2019	CAL_POINT_LO	-2	-2 to 16	Lowest calibration point
2020	CAL_MIN_SPAN	1	1 to 18	Minimum span between two calibration points
2021	SLOPE	100	70 to 110%	Sensitivity of the glass electrode
2022	SLOPE_UNIT	%	%	Slope is presented as percentage of theoretical slope (59,16 mV/pH equals 100%)
2023	ZERO	0	-120 to 120 mV, mV -2 to 16 pH	A balanced electrode system gives 0 mV output at pH=7. Zero (asymmetry potential) indicates the offset in mV.
2024	ZERO_UNIT	mV	mV, pH	As an alternative to Asymmetry Potential, the Zero point can be used to define and calibrate the EXA pH transmitter conform to the DIN standard for instruments No. IEC 746-2.
2025	ISOPOTENTIAL_PH	7	-2 to 16 pH	This is the pH value at which the sensor has the same mV output independent of the process temperature.
2026	SENSOR_CAL_METHOD	0	1 point, 2 point	not used
2027	SENSOR_CAL_DATE	-	till 2104	Date the sensor was last calibrated.
2028	SECONDARY_VALUE	-	-30 to 140°C , -20 to 280 °F	Temperature value

Index	Parameter name	Factory Default	Valid Range	Description
2029	SECONDARY_VALUE_UNIT	°C	°C, °F	Temperature unit
2030	SENSOR_TEMP_COMP	automatic	Off, manual,	Select off when no temperature compensation is required.
			automatic	Select manual when no temperature element is available and the temperature is stable and select auto when a temperature element is available pH: man + auto orp: off + auto
2031	SENSOR_TEMP_MAN_VALUE	25	-30 to 140°C, -20 to 280°F	manual temperature value
2032	SENSOR_TYPE_TEMP	Pt1000	Pt1000, Pt100, 5k1, 3kBalco, 8k55, 350, NTC10k, 6k8	Temperature element used:
2033	SENSOR_CONNECTION _TEMP	2	2	Only 2-wire connections supported
2034	TERTIARY_VALUE_TYPE	None	None, ORP, rH	When a metal electrode is used in combination with a glass and reference electrode one has the possibility to measure a tertiary value:
2035	TERTIARY_VALUE	-	-1500 to 1500 mV, 0 to 55 rH	The third value is expresed in mV or rH units
2036	TERTIARY_VALUE_RANGE	-1500 to 1500	-1500 to 1500 mV, 0 to 55 rH	The high and low range limits for the tertiary value.
2037	TERTIARY_ZERO	0	-120 to 120mV	Redox offset can be set in mV.
2038	GLASS_IMPEDANCE	-	1MΩ to 2 GΩ (HI) 1kΩ to 1MΩ (LO)	Value that indicates the state of the glass membrane. Depending on the jumper setting the range is set to High or Low.
2039	REFERENCE_IMPEDANCE	-	1MΩ to 2 GΩ (HI) 1kΩ to 1MΩ (LO)	Value that indicates the state of the reference system. Depending on the jumper setting the range is set to High or Low.
2040	ALARM_SUM	-		
2041	DEV_ALARM	-		Device Alarm is used to give the status of the transmitter. Device_ status in RB displays the device Alarms.
2042	LOGBOOK1_RESET	-		Reset the pointer to the first (oldest) event in logbook 1.
2043	LOGBOOK1_EVENT	-		Event whereto the pointer is referenced. When parameter is read, the pointer is increased by one.
2044	LOGBOOK2_RESET	-		Reset the pointer to the first (oldest) event in logbook 2.
2045	LOGBOOK2_EVENT	-		Event whereto the pointer is referenced. When parameter is read, the pointer is increased by one.
2046	LOGBOOK_CONFIG	-		Per event one can decide whether it should be logged and in which logbook (1 or 2) it should be logged.
2047	TEST_1	-		Service parameter
....		-		2048 to 2058 are, like 2047 and 2059, service parameters
2059	TEST_13	-		Service parameter
2060	STABLE_TIME	5	5.0 to 30.0	Stability criteria used during automatic calibration.
2061	STABLE_VALUE	0.02	0.01 to 1.0	Stability criteria used during automatic calibration.
2062	CALL_MAINT_TIME_ COUNTDOWN	250	1 to 250	The remaining days till maintenance is required.
2063	CALL_MAINT_TIME_RELOAD	250	1 to 250	The interval of the maintenance timer.
2064	INPUT_1_IMPEDANCE_LO_LIM	1.00E6	100.0 to 1.0E9	The low limit of the input 1 impedance.
2065	INPUT_1_IMPEDANCE_HI_LIM	1.00E9	100.0 to 1.0E9	The high limit of the input 1 impedance.
2066	INPUT_2_IMPEDANCE_LO_LIM	100	100.0 to 1.0E9	The low limit of the input 2 impedance.
2067	INPUT_2_IMPEDANCE_HI_LIM	200000	100.0 to 1.0E9	The high limit of the input 2 impedance.
2068	BUFFER1_ID	4	0 to 9	The ID of buffer one, used during automatic calibration.
2069	BUFFER1	4.0	-2.0 to 16.0	The first user defined calibration buffer.
2070	BUFFER2_ID	7	0 to 9	The ID of buffer two, used during automatic calibration.
2071	BUFFER2	7.0	-2.0 to 16.0	The second user defined calibration buffer.
2072	BUFFER3_ID	9	0 to 9	The ID of buffer three, used during automatic calibration.
2073	BUFFER3	9.0	-2.0 to 16.0	The third user defined calibration buffer.
2074	TEMPERATURE_COEFFICIENT	0.0	-1.0 to 1.0 -100.0 to 100.0	The temperature coefficient of the primary value.

Index	Parameter name	Factory Default	Valid Range	Description
2075	PASSCODE_MAINTENANCE	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the maintenance menu.
2076	PASSCODE_COMMISSIONING	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the commissioning menu.
2077	PASSCODE_SERVICE	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the service menu.
2078	SAMPLE_PV			Process value of the sample taken.
2079	SAMPLE_PV2			Second process value of the sample taken.
2080	SAMPLE_TEMP			Temperature of the sample taken.
2081	ERROR_CONFIG*			Soft/Hard fail configuration (checked = hard; unchecked = soft)
2082	CONFIGURATION*			Instrument specific configuration
2083	TRANSMITTER_TIME			Transmitter time.
2084	TEST_14			Service parameter.

* Enumerated parameters (4 bytes, 32 bits) where each bit can be set individually.

Error_config
0x00002000 (bit 14), “input 1 impedance exceeds low limit (E4.1)” ,
0x00001000 (bit 13), “input 1 impedance exceeds high limit (E5.1)” ,
0x00000800 (bit 12), “input 2 impedance exceeds low limit (E4.2)” ,
0x00000400 (bit 11) “input 2 impedance exceeds high limit (E5.2)” ,
0x00000200 (bit 10), “temperature sensor open (E7)” ,
0x00000100 (bit 9), “temperature sensor shorted (E8)” ,
0x00800000 (bit 24), “primary value exceeds limits (E9)” ,
0x00010000 (bit 17), “calibration timer expired (E16)”

Configuration
0x08000000 (bit 28), “Process compensation enabled” ,
0x00800000 (bit 24), “Aspot check enabled” ,
0x00400000 (bit 23), “Slope check enabled” ,
0x00200000 (bit 22), “Display resolution 0.01 pH” ,
0x00100000 (bit 21), “Auto return enabled” ,
0x00080000 (bit 20), “Maintenance timer enabled” ,
0x00002000 (bit 14), “Input 1 impedance measurement enabled” ,
0x00008000 (bit 16), “Input 1 impedance high” ,
0x00004000 (bit 15), “Input 1 impedance compensation enabled” ,
0x00000400 (bit 11), “Input 2 impedance measurement enabled” ,
0x00001000 (bit 13), “Input 2 impedance high” ,
0x00000800 (bit 12), “Input 2 impedance compensation enabled” ,
0x00000010 (bit 5), “Take sample”

3-6-3-2 Transducer Block SC202

Index	Parameter name	Factory Default	Valid Range	Description
2000	BLOCK HEADER	TAG: “TB”		General information about thefunction block
2001	ST_REV	-	-	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed
2002	TAG_DESC	“ “		The user description of the intended application of the block
2003	STRATEGY	1		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block
2004	ALERT_KEY	1		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
2005	MODE_BLK	AUTO		The actual, target, permitted, and normal modes of the block
2006	BLOCK_ERR	-		This parameter reflects the error status associated with a block. It is a bit-string, so that multiple errors can be shown
2007	UPDATE_EVT	-		The alert is generated by any change to the static data.
2008	BLOCK_ALM	-		The block alarm is used for all configuration error, hardware connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set Active status in Status attribute.
2009	TRANSDUCER_DIRECTORY			A directory that specifies the number and starting indices of the transducers.
2010	TRANSDUCER_TYPE	Standard Conductivity	conductivity	Conductivity transducer block
2011	XD_ERROR	-		The error code in transducer: No failure, Electronics failure, I/O failure, Mechanical failure
2012	COLLECTION_DIRECTORY	-		A directory that specifies the number, starting indices and DD item Ids of the data collection in each transducer within a transducer block
2013	PRIMARY_VALUE_TYPE	Conductivity	conductivity / resistivity	Type of measurement represented by primary value
2014	PRIMARY_VALUE	-	0 to 2 S/cm	Primary value of the instrument is Conductivity
2015	PRIMARY_VALUE_RANGE	0 to 2 S/cm	0 to 2 S/cm	The range of the instrument (can not change)
2016	SENSOR_CONST	0.1	0.005 to 50 cm^{-1}	The conductivity cell has a specific cell constant determined by the dimensions of the cell
2017	CAL_POINT_HI	1.999	0 to 2 S/cm	Highest calibration point
2018	CAL_POINT_LO	0	0 to 2 S/cm	Lower calibration point
2019	CAL_MIN_SPAN	0,0001	> 0,0001 S/cm	Minimum span between two calibration points
2020	SENSOR_CAL_METHOD	-	1point, 2point	not used
2021	SENSOR_CAL_DATE	-	till 2104	Date the sensor was last calibrated
2022	SECONDARY_VALUE	-	-20 to 250 ºC , 0 to 500ºF	Temperature value
2023	SECONDARY_VALUE_UNIT	ºC	ºC, ºF	Temperature unit
2024	SENSOR_TEMP_COMP	automatic	automatic	
2025	SENSOR_TEMP_MAN_VALUE	-	-	No manual temp. value can be set. Always Automatic
2026	SENSOR_TYPE_TEMP	Pt1000	Pt1000, Pt100, Ni100, Pb36, 8k55	Temperature element used:
2027	SENSOR_CONNECTION_ TEMP	2	2	Only 2-wire connections supported
2028	SENSOR_TYPE_COND	contact 2-electrode	2-electrode, 4-electrode	Either 2-electrode or 4-electrode contacting conductivity cell can be selected
2029	SENSOR_OHMS	-		Actual cell resistance
2030	XD_MAN_ID	“ “		
2031	TEMPERATURE_COEFF	2.1	0 to 3.5%/ºC (%/ºF)	Process temperature compensation factor
2032	CONCENTRATION	-	-	Conductivity combined with temperature can be directly related to the concentration. Concentraion is expressed in percentage
2033	TERTIARY_VALUE	-	0 to 2 S/cm	Second compensated conductivity value

Index	Parameter name	Factory Default	Valid Range	Description
2034	REFERENCE_ TEMPERATURE	25	0 to 100 ºC, 32 to 212 ºF	Conductivity can be process compensated to a standard reference temperature. Mostly 20ºC or 25ºC is used
2035	COMP_METHOD	NaCl	NaCl, TC, matrix	Method of process temp. compensation for the primary value
2036	COMP_MATRIX_SEL	HCl	HCl cation (0-80 °C) Ammonia, (0-80 °C) Ammonia, (0-80 °C) HCl (0-5%, 0-60 °C) NaOH (0-5%, 0-100 °C), User defined	When matrix compensation is required one can make a selection out of 5 predefined matrices and one user definable matrix
2037	TERTIARY_COMP_METHOD	NaCl	NaCl, TC, matrix	Method of process temperature compensation for the second conductivity value
2038	TERT_TEMPERATURE _COEFF	2.1	0 to 3.5%/ºC	Process temperature compensation factor for the second conductivity value
2039	ALARM_SUM	-		
2040	DEV_ALARM	-		Device Alarm is used to give the status of the analyser. See separate table for error messages
2041	LOGBOOK1_RESET	Idle	Idle, Reset	Reset the pointer to the first (oldest) event in logbook 1
2042	LOGBOOK1_EVENT	-		Event whereto the pointer is referenced. When parameter is read, the pointer is increased by one.
2043	LOGBOOK2_RESET	Idle	Idle, Reset	Reset the pointer to the first (oldest) event in logbook 2
2044	LOGBOOK2_EVENT	-		Event whereto the pointer is referenced. When parameter is read, the pointer is increased by one
2045	LOGBOOK_CONFIG[16]	-		Per event one can decide whether it should be logged and in which logbook (1 or 2) it should be logged
2046	TEST_1	-		
....		-		2047 to 2057 are, like 2046 and 2058, service parameters
2058	TEST_13	-		
2059	CALIB_SENSOR_CONST	0.1	0.005~50	The calibrated cell constant [1/cm].
2060	MATRIX_TEMP_RANGE		-20~250, 0~500	The temperature values of the user defined matrix.
2061	SOLUTION_1		0~1.999S/cm, 0~999MΩ•cm	The conductivity/resistivity values of solution 1.
2062	SOLUTION_2		0~1.999S/cm, 0~999MΩ•cm	The conductivity/resistivity values of solution 2.
2063	SOLUTION_3		0~1.999S/cm, 0~999MΩ•cm	The conductivity/resistivity values of solution 3.
2064	SOLUTION_4		0~1.999S/cm, 0~999MΩ•cm	The conductivity/resistivity values of solution 4.
2065	SOLUTION_5		0~1.999S/cm, 0~999MΩ•cm	The conductivity/resistivity values of solution 5.
2066	CONCENTRATION_ MEASUREMENT	disabled	0=Not initialized, 1=disabled, 2=enabled	Enabling/Disabling of concentration measurement.
2067	CONCENTRATION_0	0	0~100	The concentration [%] corresponding to the 0 percent table value
2068	CONCENTRATION_100	100	0~100	The concentration [%] corresponding to the 100 percent table value
2069	CONC._TABLE_LOW		0~1.999S/cm, 0~999MΩ•cm	The first part of the concentration table (0 till 30 percent).
2070	CONC._TABLE_MID		0~1.999S/cm, 0~999MΩ•cm	The second part of the concentration table (35 till 65 percent).
2071	CONC._TABLE_HIGH		0~1.999S/cm, 0~999MΩ•cm	The third part of the concentration table (70 till 100 percent).
2072	E5_LIMIT	0.25, 4	0~0.5S, 0~10MΩ	The upper range accuracy limit of the analyzer [S or Ohm].
2073	E6_LIMIT	1µ, 1M	0~0.5S, 0~10MΩ	The lower range accuracy limit of the analyzer [S or Ohm].
2074	DISPLAY_RESOLUTION	1	0 to 8	Display resolution, 0, Not initialized (can not change) 1,Auto Ranging, 2, x.xxx µS/cm, MΩ•cm, 3, xx.xx µS/cm, MΩ•cm, 4, xxx.x µS/cm, MΩ•cm, 5, x.xxx mS/cm, kΩ•cm, 6, xx.xx mS/cm, kΩ•cm, 7, xxx.x mS/cm, kΩ•cm, 8, xxxx mS/cm, kΩ•cm
2075	PASSCODE_MAINT	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the maintenance menu
2076	PASSCODE_COMM	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the commissioning menu.
2077	PASSCODE_SERVICE	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the service menu.
2078	ERROR_CONFIG*		0=soft, 1=hard	Soft/Hard fail configuration (checked = hard unchecked = soft).
2079	CONFIGURATION*	polarization on, USP off,		Instrument specific configuration. See below for correct bitnr. setting autoreturn on
2080	TRANSMITTER_TIME			Transmitter time.”
2081	TEST_14			Service parameter.

* Enumerated parameters (4 bytes, 32 bits) where each bit can be set individually.
ERROR_CONFIG
0x00008000 (bit 15), “polarization detected (E1)”
0x00000800(bit 11), “conductivity exceeds high limit (E5)”
0x00000400 (bit 10), “conductivity exceeds low limit (E6)”
0x00000200 (bit 9), “temperature sensor open (E7)”
0x00000100 (bit 8), “temperature sensor shorted (E8)”
0x00080000 (bit 19), “conductivity exceeds USP limit (E13)”
CONFIGURATION
0x00004000 (bit 14), “Polarization check enabled”
0x00800000 (bit 23), “Auto return enabled”
0x00000001 (bit 0), “USP enabled”

3-6-3-3 Transducer Block ISC202

Index	Parameter name	Factory Default	Valid Range	Description
2000	BLOCK HEADER	TAG: “TB”		General information about thefunction block
2001	ST_REV	-	-	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed
2002	TAG_DESC	“ “		The user description of the intended application of the block
2003	STRATEGY	1		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block
2004	ALERT_KEY	1		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
2005	MODE_BLK	AUTO		The actual, target, permitted, and normal modes of the block
2006	BLOCK_ERR	-		This parameter reflects the error status associated with a block. It is a bit-string, so that multiple errors can be shown
2007	UPDATE_EVT	-		The alert is generated by any change to the static data.
2008	BLOCK_ALM	-		The block alarm is used for all configuration error, hardware connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set Active status in Status attribute.
2009	TRANSDUCER_DIRECTORY			A directory that specifies the number and starting indices of the transducers.
2010	TRANSDUCER _TYPE	Conductivity Transmitter	conductivity	Conductivity transducer block
2011	XD_ERROR	-		The error code in transducer: No failure, Electronics failure, I/O failure, Mechanical failure
2012	COLLECTION_DIRECTORY	-		A directory that specifies the number, starting indices and DD item Ids of the data collection in each transducer within a transducer block
2013	PRIMARY_VALUE_TYPE	conductivity,	conductivity	Type of measurement represented by primary value
2014	PRIMARY_VALUE	-	0 to 2 S/cm	Primary value of the instrument is Conductivity
2015	PRIMARY_VALUE_RANGE	0 to 2 S/cm	0 to 2 S/cm	The range of the instrument (can not change)
2016	SENSOR_CONST	1.88	0.2 to 19.99 cm^{-1}	The conductivity cell has a specific cell constant determined by the dimensions of the cell
2017	CAL_POINT_HI	1.999	0 to 2 S/cm	Highest calibration point
2018	CAL_POINT_LO	0	0 to 2 S/cm	Lower calibration point
2019	CAL_MIN_SPAN	0,0001	> 0,0001 S/cm	Minimum span between two calibration points
2020	SENSOR_CAL_METHOD	-	1point, 2point	not used
2021	SENSOR_CAL_DATE	-	till 2104	Date the sensor was last calibrated
2022	SECONDARY_VALUE	-	-20 to 140 ºC , 0 to 280ºF	Temperature value
2023	SECONDARY_VALUE_UNIT	ºC	ºC, ºF	Temperature unit
2024	SENSOR_TEMP	automatic	automatic	auto when a temperature element is available
2025	SENSOR_TEMP_MAN_VALUE	-	-	No manual temp. value possible. Always automatic
2026	SENSOR_TYPE _TEMP	NTC30K	Pt1000, NTC30k	Temperature element used:
2027	SENSOR_CONNECTION_ TEMP	2	2	Only 2-wire connections supported
2028	SENSOR_TYPE_COND	toroidal	toroidal	Non contacting toroidal sensor.
2029	SENSOR_OHMS	-		Actual cell resistance
2030	XD_MAN_ID	“ “		
2031	TEMPERATURE_COEFF	2.1	0 to 3.5%/ºC (%/ºF)	Process temperature compensation factor
2032	CONCENTRATION	-		Conductivity combined with temperature can be directly related to the concentration. Concentraion isexpressed in percentage
2033	TERTIARY_VALUE	-	0 to 2 S/cm	Second compensated conductivity value
2034	REFERENCE_TEMPERATURE	25	0 to 100 ºC (32 to 212ºF)	Conductivity can be process compensated to a standard reference temperature. Mostly 20ºC or 25ºC is used

Index	Parameter name	Factory Default	Valid Range	Description
2035	COMP_METHOD	NaCl	NaCl, TC, matrix	Method of process temperature compensation for the primary value
2036	COMP_MATRIX_SEL	H_2SO_4	H_2SO_4, 0 -100ºC, 0 - 5%, H_2SO_4, 0 -100ºC, 2.5 - 25%, HCl, 0 - 60ºC, 0.5 - 5%, HNO_3, 0 - 80ºC, 0.5 - 5% HNO_3, 0 -80ºC, 2.5 - 25% NaOH, 0 -100ºC, 0.5 - 5% NaOH, 0 -100ºC, 0.5 - 15% User programmable matrix	When matrix compensation is required one can make a selection out of 8 predefined matrices and one user definable matrix
2037	TERTIARY_COMP_METHOD	NaCl	NaCl, TC, matrix	Method of process temperature compensation for the second conductivity value
2038	TERT_TEMPERATURE _COEFF	2.1	0 ~ 3.5 %/ºC	Process temperature compensation factor for the second conductivity value
2039	ALARM_SUM	-		
2040	DEV_ALARM	-		Device Alarm is used to give the status of the analyser. See separate table for error messages
2041	LOGBOOK1_RESET	Idle	Idle, Reset	Reset the pointer to the first (oldest) event in logbook 1
2042	LOGBOOK1_EVENT	-		Event whereto the pointer is referenced. When parameter is read, the pointer is increased by one.
2043	LOGBOOK2_RESET	Idle	Idle, Reset	Reset the pointer to the first (oldest) event in logbook 2
2044	LOGBOOK2_EVENT	-		Event whereto the pointer is referenced. When parameter is read, the pointer is increased by one
2045	LOGBOOK_CONFIG	-		Per event one can decide whether it should be logged and in which logbook (1 or 2) it should be logged
2046	TEST_1	-		
....		-		2047 to 2057 are, like 2046 and 2058, service parameters
2058	TEST_13	-		
2059	CALIB_SENSOR_CONST	1.88	0.2~19.99 cm^{-1}	The calibrated cell constant [1/cm].
2060	MATRIX_TEMP_RANGE		-20~140ºC, 0~280ºF	The temperature values of the user defined matrix.
2061	SOLUTION_1		0~1.999 S/cm	The conductivity values of solution 1.
2062	SOLUTION_2		0~1.999 S/cm	The conductivity values of solution 2.
2063	SOLUTION_3		0~1.999 S/cm	The conductivity values of solution 3.
2064	SOLUTION_4		0~1.999 S/cm	The conductivity values of solution 4.
2065	SOLUTION_5		0~1.999 S/cm	The conductivity values of solution 5.
2066	CONCENTRATION_ MEASUREMENT	disabled	0=Not initialized, 1=disabled, 2=enabled	Enabling/Disabling of concentration measurement.
2067	CONCENTRATION_0	0	0~100	The concentration [%] corresponding to the 0 percent table value
2068	CONCENTRATION_100	100	0~100	The concentration [%] corresponding to the 100 percent table value
2069	CONC._TABLE_LOW		0~1.999 S/cm	The first part of the concentration table (0 till 30 percent).
2070	CONC._TABLE_MID		0~1.999 S/cm	The second part of the concentration table (35 till 65 percent).
2071	CONC._TABLE_HIGH		0~1.999 S/cm	The third part of the concentration table (70 till 100 percent).
2072	E5_LIMIT	3 (3 S)	0~5 S	The upper range accuracy limit of the analyzer [Siemens].
2073	E6_LIMIT	5e-6 (5 µS)	0~5 S	The lower range accuracy limit of the analyzer [Siemens].
2074	DISPLAY_RESOLUTION	1	0 to 8	Display resolution, 0, Not initialized (can not change) 1, Auto Ranging, 2, x.xxx µS/cm, 3, xx.xx µS/cm, 4, xxx.x µS/cm, 5, x.xxx mS/cm, 6, xx.xx mS/cm, 7, xxx.x mS/cm, 8, xxxx mS/cm
2075	PASSCODE_MAINT	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the maintenance menu
2076	PASSCODE_COMM	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the commissioning menu.
2077	PASSCODE_SERVICE	0	0, 111, 333, 777,	Passcode used to protect the service menu. 888, 123, 957, 331, 546, 847
2078	ERROR_CONFIG*		0=soft, 1=hard	Soft/Hard fail configuration (checked = hard unchecked = soft).
2079	CONFIGURATION*	autoreturn on bitnr. setting		Instrument specific configuration. See below for correct
2080	TRANSMITTER_TIME			Transmitter time."
2081	TEST_14			Service parameter.

* Enumerated parameters (4 bytes, 32 bits) where each bit can be set individually.
ERROR_CONFIG
0x00000800(bit 11), “conductivity exceeds high limit (E5)”
0x00000400 (bit 10), “conductivity exceeds low limit (E6)”
0x00000200 (bit 9), “temperature sensor open (E7)”
0x00000100 (bit 8), “temperature sensor shorted (E8)”
CONFIGURATION
0x00800000 (bit 23), “Auto return enabled”

3-6-3-4 Transducer Block DO202

Index	Parameter Name	Factory Default	Valid Range	Description
2000	BLK_DATA	TAG: “TB”		General information about the function block
2001	ST_REV	-	-	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2002	TAG_DESC	“ “		The user description of the intended application of the block.
2003	STRATEGY	1		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block
2004	ALERT_KEY	1		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
2005	MODE_BLK	AUTO		The actual, target, permitted, and normal modes of the block
2006	BLOCK_ERR	-		This parameter reflects the error status associated with a block. It is a bit-string, so that multiple errors can be shown.
2007	UPDATE_EVT	-		The alert is generated by any change to the static data.
2008	BLOCK_ALM	-		The block alarm is used for all configuration error, hardware connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set Active status in Status attribute.
2009	TRANSDUCER _DIRECTORY			A directory that specifies the number and starting indices of the transducers.
2010	TRANSDUCER_TYPE	DO	DO	Yokogawa specific Dissolved Oxygen transducer block
2011	XD_ERROR	-		The error code in transducer: - No failure - Electronics failure - I/O failure - Mechanical failure
2012	COLLECTION _DIRECTORY	-		A directory that specifies the number, starting indices and DD item IDs of the data collection in each transducer within a transducer block.
2013	PRIMARY_VALUE _TYPE	Dissolved Oxygen	Dissolved Oxygen	The type of measurement represented by primary value.
2014	PRIMARY_VALUE	-	0 to 50 ppm 0 to 1999 ppb 0 to 600 %	Primary measuring value of the instrument including status information.
2015	PRIMARY_VALUE _RANGE	-	0 to 50 ppm 0 to 1999 ppb 0 to 600 %	The measuring range of the instrument associated with the selected unit type.
2016	PRIMARY_VALUE_UNIT	ppm	ppm, ppb, %	Select the unit in which the primary value must be presented
2017	SENSOR_TYPE _OXYGEN	Polarographic	Polarographic, Galvanic	Select the type of sensor connected to the instrument, Galvanic or Polarographic
2018	SAMPLE_CAL	-	0 to 50 ppm 0 to 1999 ppb 0 to 600 %	Enter the correct (current) measured value. This value is used to calculate the new sensitivity (slope)
2019	ZERO_CURRENT	0	+- ZERO_CURRENT _LIMIT (param 2037)	Directly overwrites the current zero current, which is the leak current of the sensor
2020	SENSITIVITY	7.5	1.000 to 1999 nA/ppm	Directly overwrites the sensitivity (slope) of the sensor
2021	AMP_STABILIZE_TIME	60	5 to 600 seconds	Stability criteria used during automatic calibration.
2022	AMP_SPAN_STABILIZE _VALUE	0.1	0 to 50 ppm	Stability criteria used during automatic span calibration.

Index	Parameter Name	Factory Default	Valid Range	Description
2023	AMP_ZERO_STABILIZE _VALUE	-	0 to 50 ppm 0 to 1999 ppb 0 to 600 %	Stability criteria used during automatic zero calibration.
2024	SALINITY	0	0 to 99.9 ppt	Salinity value of the process liquid that can be used to compensate the DO value
2025	BAR_PRESSURE	101.3	0.0 to 999 kPa	Manual value of the pressure used to compensate the DO reading (during calibration)
2026	BAR_PRESSURE_UNIT	kPa	kPa	The engineering unit of barometric pressure value
2027	PERCENT_SATURATION _PRESSURE	101.3	0.0 to 999 kPa	Manual value of the pressure used to compensate the DO reading (during measuring)
2028	CHLORINE_CALI-BRATION_RANGES			not used
2029	SECONDARY_VALUE	-	-20 to 150 °C, -4 to 302 °F	Temperature value
2030	SECONDARY_VALUE _UNIT	°C	°C, °F	Temperature unit
2031	SENSOR_TEMP_COMP	automatic	automatic, manual	Select manual when no temperature element is available and the temperature is stable and select auto when a temperature element is available
2032	SENSOR_TEMP_MAN _VALUE	25°	0 - 100 °C 32 - 212 °F	manual temperature value
2033	SENSOR_TYPE_TEMP	NTC22K	NTC22K, Pb36, PT1000	Temperature element used
2034	TEMP_SENSOR_CAL	-	-20 to 150 °C, -4 to 302 °F	Enter the correct (current) measured value. This value is used to calculate the temperature offset
2035	SENSOR_CURRENT	-	0 to 1200 nA, 0 to 50 µA	The actual cell current of the DO sensor
2036	PERCENT_SATURATION	-	0 to 600 %	The DO value expressed as a percentage of the maximum saturation.
2037	ZERO_CURRENT_LIMIT		0 to 199.9 nA, 0 to 19.99 µA	Limit used during zero calibration for the sensor current (different for polarographic or galvanic sensor)
2038	ZERO_CAL	-	0 to 50 ppm 0 to 1999 ppb 0 to 600 %	Enter the correct (current) measured value. This value is used to calculate the new offset (zero)
2039	RESERVED1			not used
2040	RESERVED2			not used
2041	RESERVED3			not used
2042	TRANSMITTER_TIME[6]			Transmitter time.
2043	PASSCODE _MAINTENANCE	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the maintenance menu.
2044	PASSCODE _COMMISSIONING	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the commissioning menu
2045	PASSCODE_SERVICE	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847	Passcode used to protect the service menu.
2046	LOGBOOK1_RESET	-		Reset the pointer to the first (oldest) event in logbook 1.
2047	LOGBOOK1_EVENT	-		Event whereto the pointer is referenced. When parameter is read, the pointer is increased by one.
2048	LOGBOOK2_RESET	-		Reset the pointer to the first (oldest) event in logbook 2.
2049	LOGBOOK2_EVENT	-		Event whereto the pointer is referenced. When parameter is read, the pointer is increased by one.
2050	LOGBOOK_CONFIG[25]	-		Per event one can decide whether it should be logged and in which logbook (1 or 2) it should be logged.
2051	CALL_MAINT_TIME _RELOAD	250	1 to 250 days	The interval of the maintenance timer
2052	CALL_MAINT_TIME _COUNTDOWN	250	1 to 250 days	The remaining days till maintenance is required.
2053	ERROR_CONFIG*	E9,E2,E7,E8 hard fail. E16 soft fail		Soft/Hard fail configuration (checked = hard; unchecked = soft)

Index	Parameter Name	Factory Default	Valid Range	Description
2054	CONFIGURATION*			Instrument specific configuration
2055	ALARM_SUM	-		
2056	DEV_ALARM	-		Device Alarm is used to give the status of the transmitter. Device_status in RB displays the device Alarms.
2057	TEST_1	-		Service parameter
….		-		2058 to 2068 are, like 2057 and 2070, service parameters
2070	TEST_14	-		Service parameter

* Enumerated parameters (4 bytes, 32 bits) where each bit can be set individually.

Error_config
0x00800000 (bit 23), “Sensor current abnormal (E9)”
0x00010000 (bit 16), “Call for maintenance (E16)”
0x00004000 (bit 14), “Zero out of limits (E2)”
0x00000200 (bit 9), “Temperature sensor open (E7)”
0x00000100 (bit 8), “Temperature sensor shorted (E8)”

Configuration
0x00008000 (bit 15), “Zero calibration enabled”
0x00001000 (bit 12), “Auto return on”
0x00000800 (bit 11), “Salinity compensation on”
0x00000400 (bit 10), “Call for maintenance on”
0x00000100 (bit 8), “Manual pressure in maintenance menu”

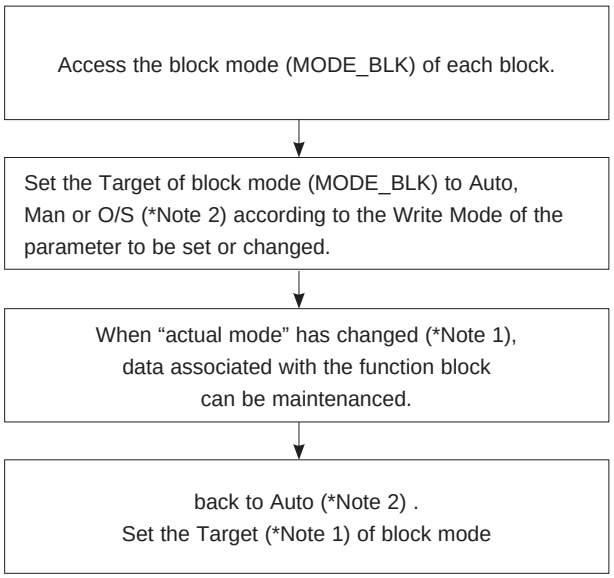
3-7 Application setting and change of basic parameters

3-7-1 Applications and selection of basic parameters

Setting Item (applicable parameters)	Summary
Tag No.	Sets PD Tag and each block tag. Up to 32 alphanumeric characters can be set for both tags. Refer to “Tag and address” in Section 3-3-4
Calibration range setup (XD_SCALE)	Sets the range of input from the transducer block corresponding to the 0% and 100% points in operation within the AI function block. The calibrated range (0% and 100%) is the factory default setting. Sets the range unit number of decimals required.
Output scale setup (OUT_SCALE)	Sets the scale of output corresponding to the 0% and 100% points in operation within the AI function block. It is possible to set a unit and scale that differs from the calibration range. Sets the range unit and the number of decimals required.
Output mode setup (L_TYPE)	Selects the operation function of the AI function block. It may be chosen from among Direct, Indirect, and IndirectSQRT. Direct: The output of the transducer block is directly output only via filtering without scaling and square root extraction. Indirect: Output processed by proportion at the AI function block. IndirectSQRT: Output processed by square root extraction at the AI function block.
Output signal low cut mode setup (LOW_CUT)	If the output falls below the setting of this parameter, the output is set to Zero. It can be set individually with Direct, Indirect, and IndirectSQRT.
Damping time constant setup (PV_FTIME)	Sets the time constant of the damping (primary delay) function in the AI function block in seconds.
Simulation setup (SIMULATE)	Performs simulation of the AI function block. The input value and status for the calibration range can also be set. It is recommended that this parameter be used for loop checks and other purposes. Refer to “Simulation Function” in Section 3-4-3.

3-7-2 Setting and change of basic parameters

This section describes the procedure taken to set and change the parameters for each block. Obtaining access to each parameter differs depending on the configuration system used.
For details, refer to the instruction manual for each configuration system.



IMPORTANT

Do not turn the power OFF immediately after parameter setting. When the parameters are saved to the EEPROM, the redundant processing is executed for an improvement of reliability. Should the power be turned OFF within 60 seconds after setting of parameters, changed parameters are not saved and may return to their original values.

Note 1: Block mode consists of the following four modes that are controlled by the universal parameter that displays the running condition of each block.
Target: Sets the operating condition of the block.
Actual: Indicates the current operating condition.
Permit: Indicates the operating condition that the block is allowed to take.
Normal: Indicates the operating condition that the block will usually take.
Note 2: The following are the operating conditions which the individual blocks will take.

Refer to the “List of parameters for each block of the EXA” for details of the Write Mode for each block.

	AI Function Block	Transducer Block	Resource Block
Automatic (Auto)	Yes	Yes	Yes
Manual (Man)	Yes		
Out of Service (O/S)	Yes	Yes	Yes

3-7-3 Setting the AI Function Blocks

(1) Setting the output scale

As explained in section 3-3-6-4 the OUT_SCALE can used to convert the channel’s value to a different scale. If the channel’s unit (= XD_SCALE unit) is the same as the output unit DO NOT use scaling or let the OUT_SCALE have the same scaling as XD_SCALE. If L_TYPE is set to Indirect or Ind Sqr Root, OUT_SCALE determines the conversion from FIELD_VAL to the output. PV and OUT always have identical scaling. OUT_SCALE provides scaling for PV. The PV is always the value that the block will place in OUT if the mode is Auto.

For AI1 set L_TYPE to Direct

With the EXA, the channel values are displayed on the display indicator, independant of the scaling in the AI blocks.

(2) Setting the output mode

Access the L_TYPE parameter.
Set the output mode.

1: Direct	(Sensor output value)
2: Indirect	(Linear output value)
3: IndirectSQRT	(Square root extraction output value)

(3) Setting the damping time constant

Access the PV_FTIME parameter.
Set the damping time (in seconds).

(4) Simulation

By optionally setting the input value to the calibration range and status, perform simulation of the AI function block.

Access the Simulate Value parameter.
Set an optional input value.

↓

Access the Simulate Status parameter.
Set the status code.

↓

Access the Simulate En/Disable parameter.
Set whether Simulation is enabled or disabled.
2: Enabled
1: Disabled

If simulation is enabled, AI block uses Simulate Status and Simulate Value as the input, and if disabled, the AI block uses Transducer Status and Transducer Value as input.
Refer to Section 3.4.3 Simulation Function.

3-7-4 Setting the Transducer Block

To access function specifics of the EXA of the transducer block, the DD (Device Description) for EXA needs to have been installed in the configuration tool used. For integration of DD, refer to “Integration of DD” in Section 3-2-4.

3-8 Operation of each parameter in failure mode

3-8-1 Operation of each parameter in failure mode PH202

• Following table summarizes the value of EXA parameters when LCD display indicates an Alarm.

EXA display	error description	resource block	transducer block	transducer block	transducer block	
		BLOCK_ERR	DEV_ALARM	BLOCK_ERR	XD_ERROR	
E9	primary value exceeds limits		0x80000000	INPUT_FAILURE_ERR	MECHANICAL_FAILURE	
E12	tertiary value exceeds limits		0x40000000	INPUT_FAILURE_ERR	MECHANICAL_FAILURE	
E7	temperature sensor open		0x20000000	INPUT_FAILURE_ERR	MECHANICAL_FAILURE	
E8	temperature sensor shorted		0x10000000	INPUT_FAILURE_ERR	MECHANICAL_FAILURE	
E5.1	glass impedance exceeds high limit		0x08000000	INPUT_FAILURE_ERR	MECHANICAL_FAILURE	
E4.1	glass impedance exceeds low limit		0x04000000	INPUT_FAILURE_ERR	MECHANICAL_FAILURE	
E5.2	reference impedance exceeds high limit		0x02000000	INPUT_FAILURE_ERR	MECHANICAL_FAILURE	
E4.2	reference impedance exceeds low limit		0x01000000	INPUT_FAILURE_ERR	MECHANICAL_FAILURE	
E16	calibration timer expired		0x00800000	NEEDS_MAINT_NOW_ERR		
	not used		0x00400000			
	not used		0x00200000			
	not used		0x00100000			
	not used		0x00080000			
	not used		0x00040000			
	mismatch between FF interface and EXA parameter		0x00020000	NEEDS_MAINT_NOW_ERR	ELECTRONICS_FAILURE	
E20	EXA eeprom failure		0x00010000	NEEDS_MAINT_NOW_ERR	DATA_INTEGRITY_ERROR	
	FF interface eeprom failure	LOST_STATIC_ERR, LOST_NV_ERR	0x00008000	NEEDS_MAINT_NOW_ERR	DATA_INTEGRITY_ERROR	
	Hart communication failure		0x00004000	NEEDS_MAINT_NOW_ERR	ELECTRONICS_FAILURE	
E21	EXA checksum error		0x00002000		ELECTRONICS_FAILURE	
	FF interface checksum error		0x00001000			
	resource block out of service	OUT_OF_SERVICE_ERR	0x00000800			
	transducer block out of service		0x00000400	OUT_OF_SERVICE_ERR		
	AI1 out of service		0x00000200			
	AI1 in manual mode		0x00000100			
	AI1 in simulation mode	SIMULATE_ACTIVE_ERR	0x00000080			
	AI1 not scheduled		0x00000040			
	AI2 out of service		0x00000020			
	AI2 in manual mode		0x00000010			
	AI2 in simulation mode	SIMULATE_ACTIVE_ERR	0x00000008			
	AI3 out of service		0x00000004			
	AI3 in manual mode		0x00000002			
	AI3 in simulation mode	SIMULATE_ACTIVE_ERR	0x00000001			

	transducer block	transducer block	transducer block	AI1 (channel = 1)	AI2 (channel = 2)	AI3 (channel = 3)
	PV.status	SV.status	TV.status	OUT.status	OUT.status	OUT.status
	BAD, SENS_FAIL			BAD, SENS_FAIL		
			BAD, SENS_FAIL			BAD, SENS_FAIL
	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, SENS_FAIL		BAD, SENS_FAIL	BAD, SENS_FAIL		BAD, SENS_FAIL
	BAD, SENS_FAIL		BAD, SENS_FAIL	BAD, SENS_FAIL		BAD, SENS_FAIL
	BAD, SENS_FAIL		BAD, SENS_FAIL	BAD, SENS_FAIL		BAD, SENS_FAIL
	BAD, SENS_FAIL		BAD, SENS_FAIL	BAD, SENS_FAIL		BAD, SENS_FAIL
	BAD, NON_SPECIFIC		BAD, NON_SPECIFIC	BAD, NON_SPECIFIC		BAD, NON_SPECIFIC
	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL
	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL
	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL
	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL
	BAD, DEV	BAD, DEV	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL	BAD, DEV_FAIL
	_FAIL	_FAIL				
	BAD, NON_SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_SPECIFIC
	BAD, OUT_OF_SERVICE	BAD, OUT_OF_SERVICE	BAD, OUT_OF_SERVICE	BAD, NON_SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_SPECIFIC
				BAD, OUT_OF_SERVICE		
					BAD, OUT_OF_SERVICE	
						BAD, OUT_OF_SERVICE

3-8-2 Operation of each parameter in failure mode SC202

• Following table summarizes the value of EXA parameters when LCD display indicates an Alarm.

error description	EXA display	dev_alarm	resource block	transducer block				
			BLOCK_ERR	BLOCK_ERR	XD_ERROR	PV.status	SV.status	
conductivity exceeds high limit	E5	0x80000000		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	BAD, SENS_FAIL		
conductivity exceeds low limit	E6	0x40000000		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	BAD, SENS_FAIL		
temperature sensor open	E7	0x20000000		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	BAD, SENS_FAIL	BAD, SENS_FAIL	
temperature sensor shorted	E8	0x10000000		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	BAD, SENS_FAIL	BAD, SENS_FAIL	
temperature compensation error	E2	0x08000000				BAD, NON_SPECIFIC		
polarization detected	E1	0x04000000		INPUT_FAILURE_ERR		BAD, NON_SPECIFIC		
conductivity exceeds usp limit	E13	0x02000000				BAD, NON_SPECIFIC		
concentration table error	E18	0x01000000				BAD, CONFIG_ERR		
matrix error	E4	0x00800000				BAD, CONFIG_ERR		
not used		0x00400000						
not used		0x00200000						
not used		0x00100000						
not used		0x00080000						
not used		0x00040000						
mismatch between FF interface and EXA parameter		0x00020000		NEEDS_MAINT_NOW_ERR	ELECTRONICS_FAILURE	BAD, DEV_FAIL_FAILURE	BAD, DEV	
EXA eeprom failure	E20	0x00010000		NEEDS_MAINT_NOW_ERR	DATA_INTEGRITY_ERROR	BAD, DEV_FAIL	BAD, DEV_FAIL	
FF interface eeprom failure		0x00008000	LOST_STATIC_ERR, LOST_NV_ERR	NEEDS_MAINT_NOW_ERR	DATA_INTEGRITY_ERROR	BAD, DEV_FAIL	BAD, DEV_FAIL	
Hart communication failure		0x00004000		NEEDS_MAINT_NOW_ERR	ELECTRONICS_FAILURE	BAD, DEV_FAIL	BAD, DEV_FAIL	
EXA checksum error	E21	0x00002000			ELECTRONICS_FAILURE	BAD, DEV_FAIL	BAD, DEV_FAIL	
FF interface checksum error		0x00001000						
resource block out of service		0x00000800	OUT_OF_SERVICE_ERR			BAD, NON_SPECIFIC	BAD, NON_SPECIFIC	
transducer block out of service		0x00000400		OUT_OF_SERVICE_ERR		BAD, OUT_OF_SERVICE	BAD, OUT_OF_SERVICE	
AI1 out of service		0x00000200						
AI1 in manual mode		0x00000100						
AI1 in simulation mode		0x00000080	SIMULATE_ACTIVE_ERR					
AI1 not scheduled		0x00000040						
AI2 out of service		0x00000020						
AI2 in manual mode		0x00000010						
AI2 in simulation mode		0x00000008	SIMULATE_ACTIVE_ERR					
AI3 out of service		0x00000004						
AI3 in manual mode		0x00000002						
AI3 in simulation mode		0x00000001	SIMULATE_ACTIVE_ERR					

			channel = 1 (AI1)	channel = 2 (AI2)	channel = 3 (AI3)	channel = 4
	TV.status	CONCENTRATION.status	OUT.status	OUT.status	OUT.status	OUT.status
	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS _FAIL		BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS _FAIL		BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, NON _SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_ SPECIFIC		BAD, NON_ SPECIFIC	BAD, NON_SPECIFIC
	BAD, NON _SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_ SPECIFIC		BAD, NON_ SPECIFIC	BAD, NON_SPECIFIC
	BAD, NON _SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_ SPECIFIC		BAD, NON_ SPECIFIC	BAD, NON_SPECIFIC
	BAD, CONFIG _ERR	BAD, CONFIG_ERR	BAD, CONFIG _ERR		BAD, CONFIG_ ERR	BAD, CONFIG_ERR
	BAD, CONFIG	BAD, CONFIG_ERR	BAD, CONFIG		BAD, CONFIG_	BAD, CONFIG_ERR
	_ERR		_ERR		ERR	
	BAD, DEVL _FAIL	_FAI	BAD, DEV	BAD, DEV_FAIL _FAIL	BAD, DEV_	BAD, DEV_FAIL FAIL
	BAD, DEV _FAIL		BAD, DEV _FAIL	BAD, DEV_FAIL	BAD, DEV_ FAIL	BAD, DEV_FAIL
	BAD, DEV _FAIL		BAD, DEV _FAIL	BAD, DEV_FAIL	BAD, DEV_ FAIL	BAD, DEV_FAIL
	BAD, DEV _FAIL		BAD, DEV _FAIL	BAD, DEV_FAIL	BAD, DEV_ FAIL	BAD, DEV_FAIL
	BAD, DEV _FAIL		BAD, DEV _FAIL	BAD, DEV_FAIL	BAD, DEV_ FAIL	BAD, DEV_FAIL
	BAD, NON_ SPECIFIC		BAD, NON _SPECIFIC	BAD, NON_ SPECIFIC	BAD, NON_ SPECIFIC	BAD, NON_SPECIFIC
	BAD, OUT_ OF_SERVICE		BAD, NON _SPECIFIC	BAD, NON_ SPECIFIC	BAD, NON_ SPECIFIC	BAD, NON_SPECIFIC
			BAD, OUT_OF _SERVICE			
				BAD, OUT_ OF_SERVICE		
					BAD, OUT_ OF_SERVICE	

3-8-3 Operation of each parameter in failure mode ISC202

• Following table summarizes the value of EXA parameters when LCD display indicates an Alarm.

error description	EXA display	dev_alarm	resource block	transducer block				
			BLOCK_ERR	BLOCK_ERR	XD_ERROR	PV.status	SV.status	
conductivity exceeds high limit	E5	0x80000000		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	BAD, SENS_FAIL		
conductivity exceeds low limit	E6	0x40000000		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	BAD, SENS_FAIL		
temperature sensor open	E7	0x20000000		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	BAD, SENS_FAIL	BAD, SENS_FAIL	
temperature sensor shorted	E8	0x10000000		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	BAD, SENS_FAIL	BAD, SENS_FAIL	
temperature compensation error	E2	0x08000000				BAD, NON_SPECIFIC		
concentration table error	E18	0x01000000				BAD, CONFIG_ERR		
matrix error	E4	0x00800000				BAD, CONFIG_ERR		
not used		0x00400000						
not used		0x00200000						
not used		0x00100000						
not used		0x00080000						
not used		0x00040000						
mismatch between FF interface and EXA parameter		0x00020000		NEEDS_MAINT_	ELECTRONICS NOW_ERR	BAD, DEV_FAIL_FAILURE	BAD, DEV	
EXA eeprom failure	E20	0x00010000		NEEDS_MAINT_NOW_ERR	DATA_INTEGRITY_ERROR	BAD, DEV_FAIL	BAD, DEV_FAIL	
FF interface eeprom failure		0x00008000	LOST_STATIC_ERR, LOST_NV_ERR	NEEDS_MAINT_NOW_ERR	DATA_INTEGRITY_ERROR	BAD, DEV_FAIL	BAD, DEV_FAIL	
Hart communication failure		0x00004000		NEEDS_MAINT_NOW_ERR	ELECTRONICS_FAILURE	BAD, DEV_FAIL	BAD, DEV_FAIL	
EXA checksum error	E21	0x00002000			ELECTRONICS_FAILURE	BAD, DEV_FAIL	BAD, DEV_FAIL	
FF interface checksum error		0x00001000						
resource block out of service		0x00000800	OUT_OF_SERVICE_ERR			BAD, NON_SPECIFIC	BAD, NON_SPECIFIC	
transducer block out of service		0x00000400		OUT_OF_SERVICE_ERR		BAD, OUT_OF_SERVICE	BAD, OUT_OF_SERVICE	
AI1 out of service		0x00000200						
AI1 in manual mode		0x00000100						
AI1 in simulation mode		0x00000080	SIMULATE_ACTIVE_ERR					
AI1 not scheduled		0x00000040						
AI2 out of service		0x00000020						
AI2 in manual mode		0x00000010						
AI2 in simulation mode		0x00000008	SIMULATE_ACTIVE_ERR					
AI3 out of service		0x00000004						
AI3 in manual mode		0x00000002						
AI3 in simulation mode		0x00000001	SIMULATE_ACTIVE_ERR					

			channel = 1 (AI1)	channel = 2 (AI2)	channel = 3 (AI3)	channel = 4
	TV.status	CONCENTRATION.status	OUT.status	OUT.status	OUT.status	OUT.status
	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS _FAIL		BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS _FAIL		BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS _FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL	BAD, SENS_FAIL
	BAD, NON _SPECIFIC	BAD, NON_SPECIFIC	BAD, NON_ SPECIFIC		BAD, NON_ SPECIFIC	BAD, NON_SPECIFIC
	BAD, CONFIG _ERR	BAD, CONFIG_ERR	BAD, CONFIG _ERR		BAD, CONFIG_ ERR	BAD, CONFIG_ERR
	BAD, CONFIG	BAD, CONFIG_ERR	BAD, CONFIG		BAD, CONFIG_	BAD, CONFIG_ERR
	_ERR		_ERR		ERR	
	BAD, DEVL _FAIL	_FAI	BAD, DEV	BAD, DEV_FAIL _FAIL	BAD, DEV_	BAD, DEV_FAIL FAIL
	BAD, DEV _FAIL		BAD, DEV _FAIL	BAD, DEV_FAIL	BAD, DEV_ FAIL	BAD, DEV_FAIL
	BAD, DEV _FAIL		BAD, DEV _FAIL	BAD, DEV_FAIL	BAD, DEV_ FAIL	BAD, DEV_FAIL
	BAD, DEV _FAIL		BAD, DEV _FAIL	BAD, DEV_FAIL	BAD, DEV_ FAIL	BAD, DEV_FAIL
	BAD, DEV _FAIL		BAD, DEV _FAIL	BAD, DEV_FAIL	BAD, DEV_ FAIL	BAD, DEV_FAIL
	BAD, NON_ SPECIFIC		BAD, NON _SPECIFIC	BAD, NON_ SPECIFIC	BAD, NON_ SPECIFIC	BAD, NON_SPECIFIC
	BAD, OUT_ OF_SERVICE		BAD, NON _SPECIFIC	BAD, NON_ SPECIFIC	BAD, NON_ SPECIFIC	BAD, NON_SPECIFIC
			BAD, OUT_OF _SERVICE			
				BAD, OUT_ OF_SERVICE		
					BAD, OUT_ OF_SERVICE	

3-8-4 Operation of each parameter in failure mode DO202

• Following table summarizes the value of EXA parameters when LCD display indicates an Alarm.

error description	**dev_alarm**	**EXA**	**resource block**	**transducer block**		**DO value**	
		eror	BLOCK_ERR	BLOCK_ERR	XD_ERROR	PV.status	
calibration not stable	0x80000000	E1					
zero out of limits	0x40000000	E2		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	
sensitivity out of limits	0x20000000	E3					
temp. sensor open	0x10000000	E7		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	
temp. sensor shorted	0x08000000	E8		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	
sensor current abnormal	0x04000000	E9		INPUT_FAILURE_ERR	MECHANICAL_FAILURE	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	
calibration timer expired	0x02000000	E16		NEEDS_MAINT_NOW_ERR		S_BAD_NON_SPECIFIC	
not used	0x01000000						
not used	0x00800000						
not used	0x00400000						
not used	0x00200000						
not used	0x00100000						
not used	0x00080000						
not used	0x00040000						
mismatch between FF interface and EXA parameter	0x00020000			NEEDS_MAINT_NOW_ERR	ELECTRONICS_FAILURE	S_QUALITY_BAD S_SUBS_DEV_FAIL S_LIMIT_NON	
EXA eeprom failure	0x00010000	E20		NEEDS_MAINT_NOW_ERR	DATA_INTEGRITY_ERROR	S_QUALITY_BAD S_SUBS_DEV_FAIL S_LIMIT_NON	
FF interface eeprom failure	0x00008000		LOST_STATIC_ERR LOST_NV_ERR	NEEDS_MAINT_NOW_ERR	DATA_INTEGRITY_ERROR	S_QUALITY_BAD S_SUBS_DEV_FAIL S_LIMIT_NON	
Hart communication failure	0x00004000			NEEDS_MAINT_NOW_ERR	ELECTRONICS_FAILURE	S_QUALITY_BAD S_SUBS_DEV_FAIL S_LIMIT_NON	
EXA checksum error	0x00002000	E21			ELECTRONICS_FAILURE	S_QUALITY_BAD S_SUBS_DEV_FAIL S_LIMIT_NON	
FF interface checksum error	0x00001000						
resource block out of service	0x00000800		OUT_OF_SERVICE_ERR			S_BAD_NON_SPECIFIC	
transducer block out of service	0x00000400			OUT_OF_SERVICE_ERR		S_BAD_OUT_OF_SERVICE	
AI1 out of service	0x00000200						
AI1 in manual mode	0x00000100						
AI1 in simulation mode	0x00000080		SIMULATE_ACTIVE_ERR				
AI1 not scheduled	0x00000040						
AI2 out of service	0x00000020						
AI2 in manual mode	0x00000010						
AI2 in simulation mode	0x00000008		SIMULATE_ACTIVE_ERR				
AI3 out of service	0x00000004						
AI3 in manual mode	0x00000002						
AI3 in simulation mode	0x00000001		SIMULATE_ACTIVE_ERR				

Temperature value	**Saturation percentage**	**Cell current**	**AI1 (channel = 1)**	**AI2 (channel = 2)**	**AI3 (channel = 3)**
SV.status	TV.status	QV.status	OUT.status	OUT.status	OUT.status
	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON
S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON
S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_QUALITY_BAD
	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_SUBS_SENS_FAIL
	S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC		S_BAD_NON_SPECIFIC
S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_QUALITY_BAD
S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_QUALITY_BAD
S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_QUALITY_BAD
S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_QUALITY_BAD
S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON		S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_LIMIT_NON	S_QUALITY_BAD S_SUBS_SENS_FAIL S_QUALITY_BAD
S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC
S_BAD_OUT_OF_SERVICE	S_BAD_OUT_OF_SERVICE	S_BAD_OUT_OF_SERVICE	S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC	S_BAD_NON_SPECIFIC
			S_BAD_OUT_OF_SERVICE		
				S_BAD_OUT_OF_SERVICE	
					S_BAD_OUT_OF_SERVICE

4. PROFIBUS

4-1. About Profibus

4-1-1 Outline

Profibus is a bi-directional digital communication protocol for field devices, which offers an advancement implementation technologies for process control systems and is widely employed by numerous field devices.

EXA Series Profibus communication type employs the specification standardized by the Profibus organisation, and provides interoperability between Yokogawa devices and those produced by other manufacturers. Profibus comes with software consisting of three AI function blocks, providing the means to implement flexible instrumentation system.

For information on other features, engineering, design, construction work, startup and maintenance of Profibus, refer to the profibus organisation website: www.profibus.com

4-1-2 Internal Structure of EXA

The EXA contains a structured mapping of function blocks. Each function block serves a specific task.

(1) Physical block
- Manages the status of EXA hardware.
- Automatically informs the host of any detected faults or other problems.

(2) Transducer block
- Converts sensor input to process values which are transfered to AI function block by channels.

(3) AI1, AI2, AI3 function blocks
- Conditions raw data from the Transducer block.
- Outputs conditioned process values
- Carries out scaling, damping and square root extraction.

4-1-3 Logical Structure of Each BLOCK

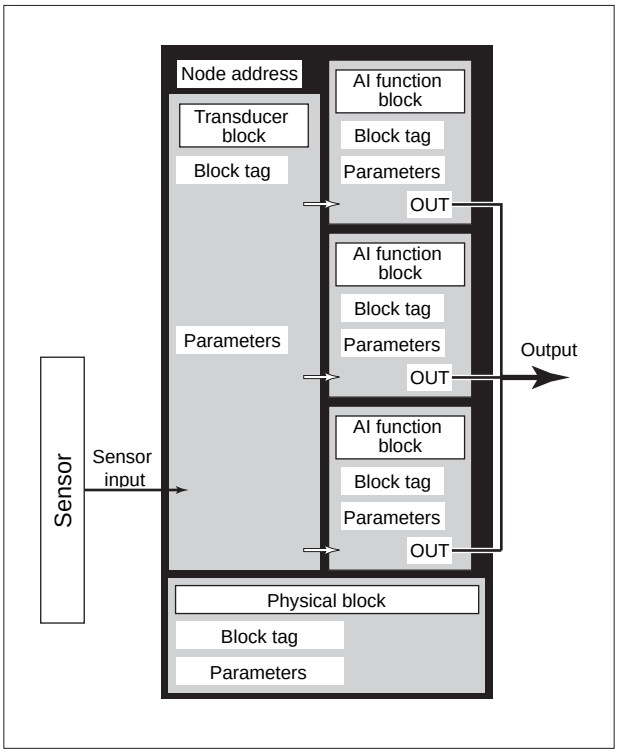


Figure 4.1 Logical Structure of Each Block

Node adress, block tags and contained parameters within a function block are structured in the EXA device as shown in figure 4.1.

4-1-4 Wiring System Configuration

The number of devices (<32) that can be connected to a single bus and the cable length vary depending on system design. When constructing systems, both the basic and overall design must be carefully considered to allow device performance to be fully exhibited.

See Figure 4.4.

Figure 4.2 Internal view of EXA wiring compartment

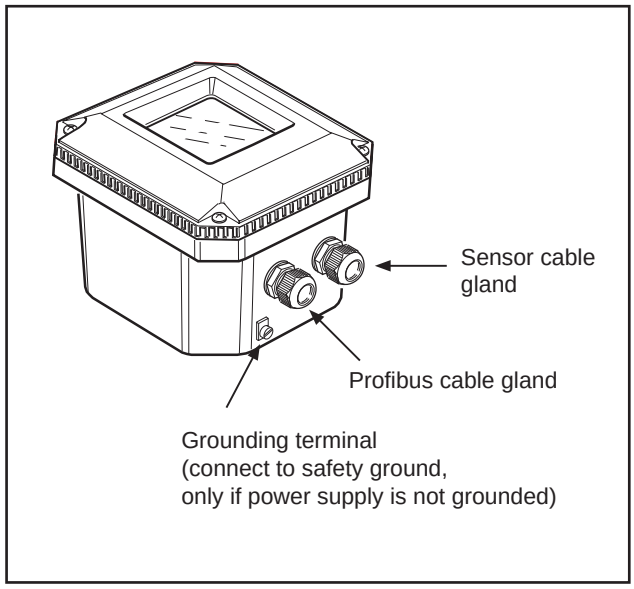


Figure 4.3 Glands to be used for cabling

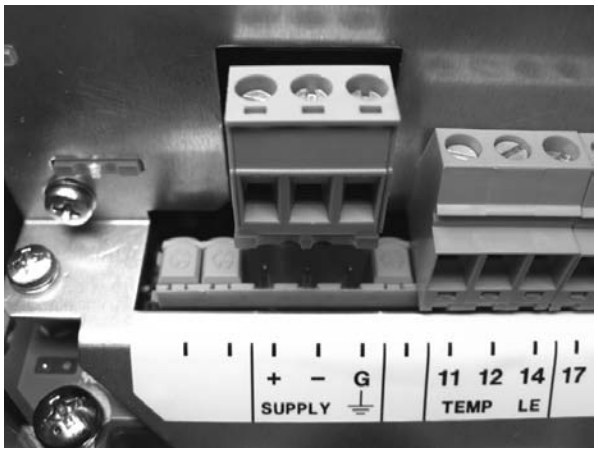


Figure 4.4 Pinhead connector

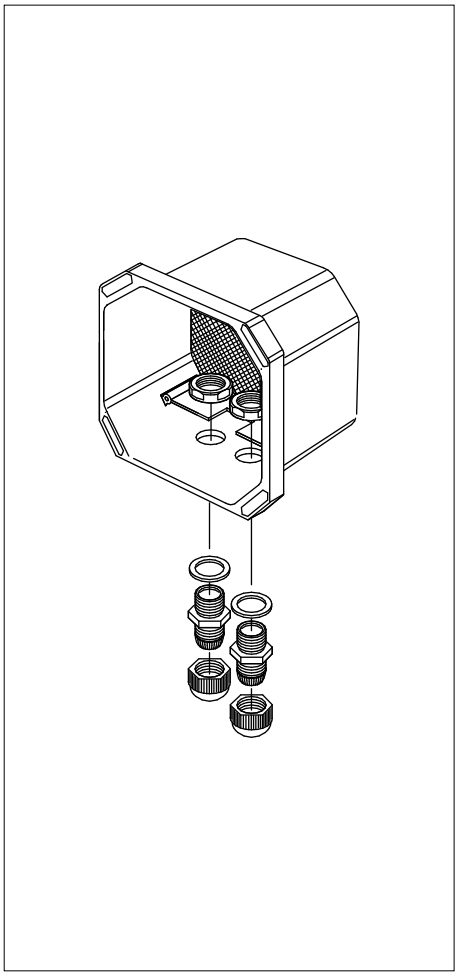


Figure 4.5 Gland connection

4-2. Preparation

The EXA 202 Profibus is provided with two cable glands. The first is used for the electrode wiring as the other is used for the power wiring shown in figure 4.3.

To open the EXA 202 for wiring:
1. Loosen the four frontplate screws and remove the cover.
2. The terminal strip is now visible.
3. Connect the power supply according figure 4.4. Use the gland on the left for this cable.
4. Connect the sensor input, using the gland on the right (see figure 4.3). Switch on the power. Commission the instrument as required or use the default settings.
5. Replace the cover and secure frontplate with the four screws.

4-2-1. Cables, terminals and glands

The EXA202 is equipped with terminals suitable for the connection of finished cables in the size range: 0.13 to 2.5 mm (26 to 14 AWG). The glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm (0.24 to 0.47 inches).

4-2-2. Shielding and grounding

Grounding and shielding of the transmitter is necessary for a safe and reliable operation. Please use one of the following schemes (A or B) as these will give proper shielding and grounding. One should pay special attention to instruments that required an external power supply (besides the 9-32V supplied by the bus).

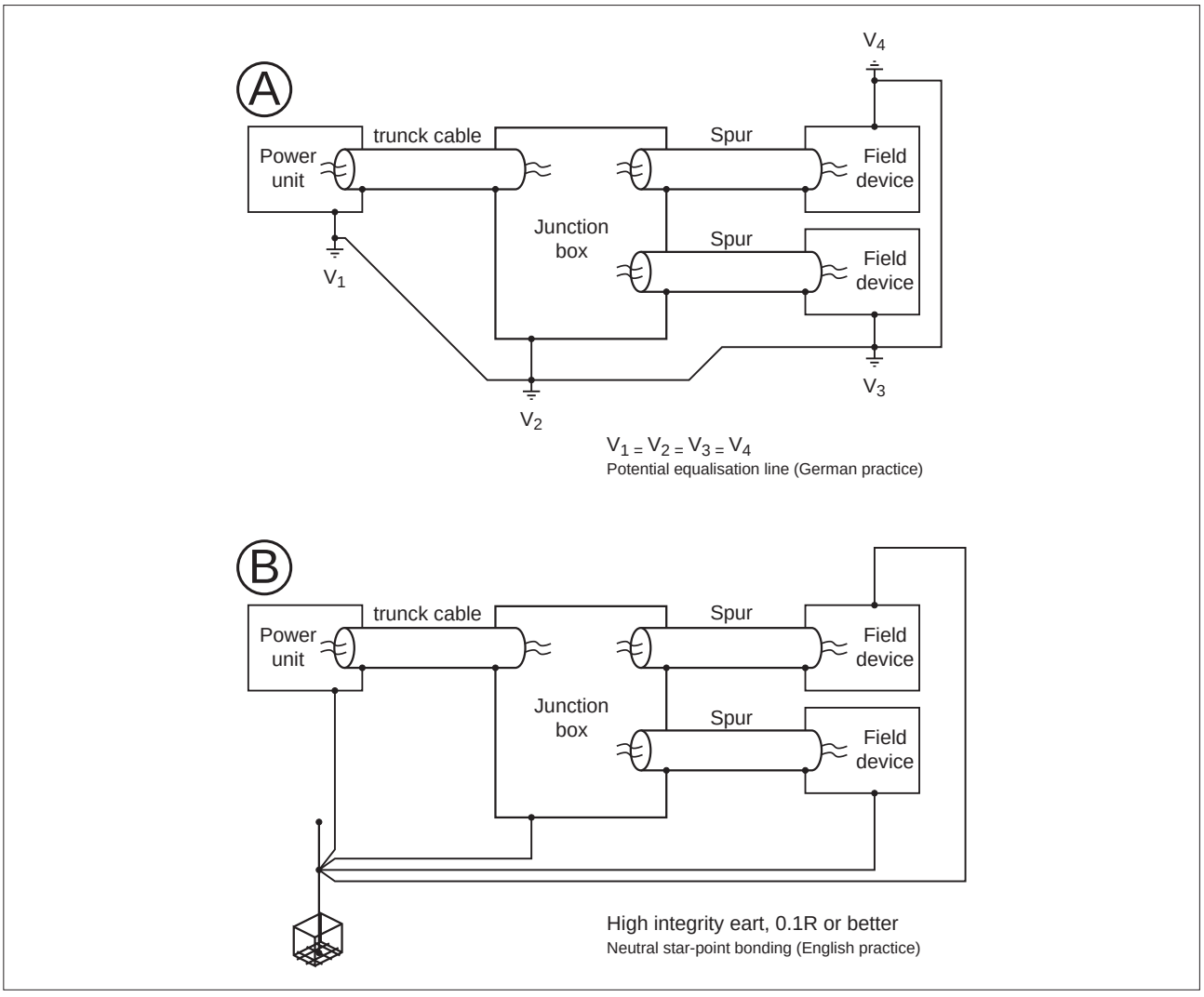


Figure 4.6 Shielding and grounding

4-3. GETTING STARTED

Profibus is fully dependent upon digital communication protocol (EN 50170 Volume 2 and IEC 61158 for IS areas, Profibus PA) and differs in operation from the conventional 4 to 20 mA transmission communication protocol. It is recommended that novice users use field devices in accordance with the procedures described in this section. The procedures assume that field devices will be set up on a bench or an instrument shop.

4-3-1 Connection of Devices

The following instruments are required for use with Profibus devices:

- **Power supply:**
  Profibus requires a dedicated power supply. It is recommended that the current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.
- **Terminator:**
  Profibus requires two terminators. Refer to the suppliers manual for details of terminators.
- **Field devices / slaves**
  Several field devices or slave devices can be connected to the same link. depending on the power consuption, up to 32 devices can be connected. A maximum of 500mA may be used so the theoretical number of devices is 500mA / Power consumption per device.
- **Host / Masters**
  Used for accessing field devices. A dedicated Master Class 1 host (such as PLC) is used for dedicated cyclic communication. A master Class 2 Host is used for device management puposes such as changing the " device address" or parameter settings. For operation of the host, refer to the instruction manual for each host. No details of the host are explained in the rest of this material.
- **Cable:**
  Used for connecting devices. Refer to IEC 61158 for details of instrumentation cabling.
  Profibus PA uses twisted pair wires up to 1900 metre. To meet the Electro Magnetic Interference standards a shielded twisted pair is obligated.

For applications in intrinsically safe areas, the transmission method defined in IEC 61158-2 is used with PROFIUS-PA The transmission rate in this case is 31.25 kbit/s. DP transmission via RS 485 to IEC 61158-2 is implemented with the network components (DP/PA coupler or DP/PA link)

Connect the devices as shown in Figure 4.7. Connect the terminators at both ends of the trunk, with a minimum length of the spur laid for connection.

The polarity of signal and power must be maintained.

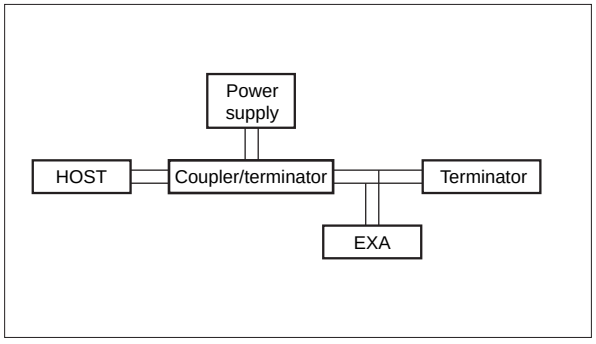


Figure 4.7 Cabling

NOTE

Before using a Profibus configuration tool other than the existing host, confirm it does not affect the loop functionality in which all devices are already installed in operation. Disconnect the relevant control loop from the bus if necessary.

IMPORTANT

Connecting a Profibus configuration tool to a loop with its existing host may cause communication data scrambles resulting in a functional disorder or a system failure.

4-3-2 Host Setting

To activate Profibus, the following settings are required for the host.

IMPORTANT

Do not turn off the power immediately after setting. When the parameters are saved to the EEPROM, the redundant processing is executed for an improvement of reliability. If the power is turned off within 60 seconds after settings are made, the modified parameters are not saved and the settings may return to their original values.

For cyclic data communication a GSD file is required. This file contains all necessary information to start this type of communication. Please make sure the gsd file is in the right directory so the information is available to the HOST. Refer to the HOST's manual for guidance.

For acyclic communication several configuration tools can be used. Each communication tool requires it's own device driver. We currently support only **Siemens Simatic PDM**. All parameter lists and methods described in this manual are based on this acyclic communication tool. Please make sure the device driver is in the proper directory. Most HOST systems come with an "install device driver" package which places all required files in the designated folders.

4-3-3 Bus Power ON

Turn on the power of the host and the bus. First all segments of the display are lit, then the display begins to operate. If the indicator is not lit, check the polarity of the power supply.

Using the host device display function, check that the EXA is in operation on the bus.
Unless otherwise specified, the following settings are in effect when shipped from the factory.

If no EXA is detected, check the available address. Please set all addresses of the devices in advance or separately connect each EXA and set a different address for each. Make sure to note the address after changing it as from this point on the device can only be accessed through this address.

4-3-4 Reading cyclic parameters

In general, slave devices exchange data cyclically with the master (class 1, e.g. PLC). The EXA (slave) gets the data from the sensor, makes some calculations and makes the outcome available through analog input blocks. The controller device (Master) requests for these process values, makes some calculation (PID, ratio) and sends the result to an actuator. The EXA contains three analog input blocks and therefore three Process values for cyclic data transfer.

The master class 1 device gets the information (of the EXA) by consulting the GSD file. A device specific GSD file should be available for each device and should have an unique identifier. All information necessary for cyclic data transfer is described in the GSD file. The YP01078X.gsd file and a bitmap file YP01078X.dib (device independent bitmap) should be placed in dedicated folders ("directories"). Refer to the manual of the Master Class 1 device for these folders. With these files, the Master Class 1 devices are able to start cyclic data transfer.

Beforehandone must configure which information will be exchanged.
According with the Profibus-PA Profile 3.01, there are two kinds of configurations possible. The Identifier byte (or short identifier) and the Extended Identifier Format (or long identifier). The EXA supports both kinds of configurations. The user can choose either “Analog Input (short)” or “Analog Input (long)” and will end up with the same result.

The function blocks of the EXA are in a specific order. The configuration of the cyclic data should be done in the same order.

For the EXA. the process values are mapped as follows:

	PH202	SC202	ISC202	DO202
slot (1) “AI1”	pH	SC1	SC1	Dissolved Oxygen
slot (2) “AI2”	Temperature	Temperature	Temperature	Temperature
slot (3) “AI3”	ORP/rH	SC2	SC2	Percent Saturation

The GSD file of the EXA 202 specifies 3 modules:

;Empty module
Module = “Empty Module” 0x00
1
EndModule
;Modules for Analog Input
Module = “Analog Input (AI)short” 0x94
2
EndModule
;Modules for Analog Input
Module = “Analog Input (AI)long” 0x42,0x84,0x81,0x81
3
EndModule

;--- Description of the module assignment: ---
;
SlotDefinition
Slot(1) = “AI1” 3 1,2,3
Slot(2) = “AI2” 3 1,2,3
Slot(3) = “AI3” 3 1,2,3

Examples:
- Configuring the output of the AI block 1 (pH) and the output of AI block 2 (temperature):
  “Analog Input (short) “ and “Analog Input (short) “ and “Empty Module” or “0x94, 0x94, 0x00”

- Configuring the output of AI block 1 (pH) only:
  “Analog Input (long) “ and “Empty module” and “Empty module” or “0x42, 0x84, 0x81, 0x81, 0x00, 0x00”

Note:
Most Master Class 1 devices have an advanced Human Machine Interface and will guide you through these configurations.

4-3-5 Reading acyclic parameters

Communications occur on a peer-to-peer basis. A cyclic communication services for parametrization, operation, monitoring, alarm/error handling and diagnostics of intelligent devices may be handled in parallel to cyclic transfer.

4-4. Function block parameters and Methods

4-4-1. Physical Block Parameters

Parameter	Default	Alternatives	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Software revision	“R3.01”		R	0,24	visible string (16)
Hardware revision	“R3.01”		R	0,25	visible string (16)
Device manufacturer ID	37hex (Yokogawa)		R	0,26	unsigned16 (2)
Device ID	PH202 “5945430850”		R	0,27	visible string (16)
	SC202 “5945430851”		R	0,27	visible string (16)
	ISC202 “5945430852”		R	0,27	visible string (16)
	DO202 “5945430853”		R	0,27	visible string (16)
Device serial number	“00000000U9313508” (example)		R	0,28	visible string (16)
Diagnosis		for details see .gsd file	R	0,29	bit string (4)
Diagnosis extension		for details see .gsd file	R	0,30	bit string (6)
Diagnosis mask			R	0,31	bit string (4)
Diagnosis mask extension			R	0,32	bit string (6)
Device certifiacation			R	0,33	visible string (32)
Write locking	Write enable (2457)	Write disable (0)	R/W	0,34	unsigned16 (2)
Factory reset	0	factory reset (1), warm start (2506), reset bus address to 126 (2712)	R/W	0,35	unsigned16 (2)
Descriptor	YOKOGAWA PROFIBUS -PA ANALYZER		R/W	0,36	visible string (32)
Device message	YOKOGAWA PROFIBUS -PA ANALYZER		R/W	0,37	visible string (32)
Device install date	“”		R	0,38	visible string (16)
Ident number selector	manufacturer specific ident no (1)	profile specific ident number (0)	R/W	0,40	unsigned8 (1)
Device configuration	“”		R	0,52	visible string (32)
Init state	run (2)		R/W	0,53	unsigned8 (1)
Device state	run (2)		R/W	0,54	unsigned8 (1)
Global status	0	bit0 - failure, bit1 - maintenance requested, bit2 - function check, bit3 - limits exceeded, bit4~15 - reserved	R	0,55	bit string (2)

4-4-2. Analog Input Block Parameters

Parameter	Default	Alternatives	R/W	Slot, Index (byte,bit)	Data Type (bytes)
AI1, AI2, AI3					
Static Revision No.			R	1,17	unsigned16 (2)
Channel	PH202: pH(284)	Temp (298), ORP/rH(305)			
	SC202: SC1(284)	Temp (292), SC2(303), Conc(302)			
	ISC202: SC1(284)	Temp (292), SC2(303), Conc(302)			
	DO202: DO(284)	Temp (299), %Sat(306), sensor current(305)	R/W	1,30	unsigned16 (2)
Linearization type	Non linearization (0)		R/W	1,29	unsigned 8 (1)
Unit			R	1,28	DS-36 (11)
Decimal point	1		R/W	1,28	DS-36 (11)
Filter Time Const			R/W	1,32	float (4)
Process Value Scale					
Lower Value			R/W	1,27	float[2] (8)
Upper Value			R/W	1,27	float[2] (8)
Output Scale					
Lower Value			R/W	1,28	DS-36 (11)
Upper Value			R/W	1,28	DS-36 (11)
Output Limits					
Upper Limit Alarm	Maximum of float		R/W	1,37	float (4)
Upper Limit Warning	Maximum of float		R/W	1,39	float (4)
Lower Limit Warning	Minimum of float		R/W	1,41	float (4)
Lower Limit Alarm	Minimum of float		R/W	1,43	float (4)
Limit Hysteresis	0.5 %		R/W	1,35	float (4)

4-4-3. Transducer block parameters

4-4-3-1. Transducer block parameters PH202

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Primary value Type	111(pH)			R	4, 27	unsigned16 (2)
Measured Value			pH	R	4, 28	DS-33 (5)
Status				R	4, 28	DS-33 (5)
Sensor type pH	pH/ORP sensor(160)	pH/ORP sensor(160)		R	4, 30	unsigned16 (2)
Sensor mV			mV	R	4, 31	float (4)
Secondary Value Parameters						
Value			ºC	R	4, 42	DS-33 (5)
Status				R	4, 42	DS-33 (5)
Secondary value unit	˚C	˚F		R/W	4, 43	unsigned16 (2)
Sensor temp comp	Automatic(2)	Off(0), Manual(1)		R/W	4, 44	unsigned8 (1)
Sensor temp man value			ºC	R/W	4, 45	float (4)
Temperature sensor	Pt1000(148)	Pt100(128), 5k1(150), 3kBalco(145), 8k55(151), 350(153), PTC10k(158), 6k8(157)		R/W	4, 46	unsigned16 (2)
Temp. connection type	1			R	4, 47	unsigned8 (1)
Process compensation	Disabled(0)	Enabled(1)		R/W	4, 167(1.0)	unsigned32 (4)
Temperature Coefficient			mV/ 10ºC	R/W	4, 159	float (4)
Tertiary Value Parameters						
Tertiary value type	None(1)	ORP(2), rH(3)		R	4, 48	unsigned16 (2)
Value			mV	R	4, 49	DS-33 (5)
Status				R	4, 49	DS-33 (5)
Calibration Parameters						
Calibration High			pH	R/W	4, 32	float (4)
Calibration Low			pH	R/W	4, 33	float (4)
Cal min span			pH	R	4, 34	float (4)
Slope check	Enabled(1)	Disabled(0)		R/W	4, 167(1.1)	unsigned32 (4)
Slope			%	R/W	4, 35	float (4)
Slope unit	%(1342)	%(1342)		R	4, 36	unsigned16 (2)
Zero check	Enabled(1)	Disabled(0)		R/W	4, 167(1.0)	unsigned32 (4)
Zero			mV	R/W	4, 37	float (4)
Zero unit	mV(1243)	pH(1422)		R/W	4, 38	unsigned16 (2)
Isopotential pH			pH	R/W	4, 39	float (4)
Tertiary zero			mV	R/W	4, 51	float (4)
Calibration method	not calibrated(0)	one point(107), two point(108), other(255)		R/W	4, 40	unsigned8 (1)
Date of Calibration				R	4, 41	DS-21
Stable Time	5.0 sec		S	R/W	4, 97	float (4)
Stable Value	0.02pH		pH	R/W	4, 98	float(4)
Diagnostic Settings						
Glass impedance			ohm	R	4, 52	float (4)
Glass impedance Lo Lim			ohm	R/W	4, 101	float (4)
Glass impedance Hi Lim			ohm	R/W	4, 102	float (4)
Glass impedance check	Enabled(1)	Disabled(0)		R/W	4, 167(2.2)	unsigned32 (4)
Glass impedance circuit	High(1)	Low(0)		R/W	4, 167(2.0)	unsigned32 (4)
Glass impedance comp.	Enabled(1)	Disabled(0)		R/W	4, 167(2.1)	unsigned32 (4)
Glass impedance exceeds low limit (E4.1)	Hard fail(1)	Soft fail(0)		R/W	4, 166(2.2)	unsigned32 (4)
Glass impedance exceeds high limit (E5.1)	Hard fail(1)	Soft fail(0)		R/W	4, 166(2.3)	unsigned32 (4)
Reference impedance			ohm	R	4, 53	float (4)
Reference impedance low limit			ohm	R/W	4, 103	float (4)
Reference impedance high limit			ohm	R/W	4, 104	float (4)
Reference impedance check	Enabled(1)	Disabled(0)		R/W	4, 167(2.5)	unsigned32 (4)

4-4-3-1. Transducer block parameters PH202 (continued)

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Reference impedance circuit	Low(0)	High(1)		R/W	4, 167 (2.3)	unsigned32 (4)
Reference impedance compensation	Disabled(0)	Enabled(1)		R/W	4, 167 (2.4)	unsigned32 (4)
Ref. impedance exceeds low limit (E4.2)	Hard fail(1)	Soft fail(0)		R/W	4, 166 (2.4)	unsigned32 (4)
Ref. impedance exceeds high limit (E5.2)	Hard fail(1)	Soft fail(0)		R/W	4, 166 (2.5)	unsigned32 (4)
Temp. sensor open (E7)	Hard fail(1)	Soft fail(0)		R/W	4, 166 (2.6)	unsigned32 (4)
Temp. sensor shorted (E8)	Hard fail(1)	Soft fail(0)		R/W	4, 166 (2.7)	unsigned32 (4)
Primary value exceeds limits (E9)	Hard fail(1)	Soft fail(0)		R/W	4, 166 (1.0)	unsigned32 (4)
Calibration timer expired (E16)	Soft fail(0)	Hard fail(1)		R/W	4, 166 (1.7)	unsigned32 (4)
Passcode Configuration						
Passcode Maintenance	-	000, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 160	unsigned16 (4)
Passcode Commissioning	-	000, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 161	unsigned16 (4)
Passcode Service	-	000, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 162	unsigned16 (4)
Display Settings						
Display precision	0.1 pH(0)	0.01 pH(1)		R/W	4, 167 (1.2)	unsigned32 (4)
Auto return	Enabled(1)	Disabled(0)		R/W	4, 167 (1.3)	unsigned32 (4)
Logbook Configuration						
power up	Logbook 2(3),	Not Logged(1), Logbook 1(2)		R/W	4, 60	unsigned8 (1)
power down	Logbook 2(3),	Not Logged(1), Logbook 1(2)		R/W	4, 61	unsigned8 (1)
system error	Logbook 1(2),	-		R	4, 62	unsigned8 (1)
defaults loaded	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 63	unsigned8 (1)
logbook erased	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 64	unsigned8 (1)
init performed	Logbook 1(2),	-		R	4, 65	unsigned8 (1)
error on	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 66	unsigned8 (1)
error off	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 67	unsigned8 (1)
temperature adjust	Logbook 1(2),	Not Logged(1), Logbook 2(3)		R/W	4, 68	unsigned8 (1)
manual temperature	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 69	unsigned8 (1)
aspot changed	Logbook 1(2),	Not Logged(1), Logbook 2(3)		R/W	4, 70	unsigned8 (1)
slope changed	Logbook 1(2),	Not Logged(1), Logbook 2(3)		R/W	4, 71	unsigned8 (1)
aspot 2 changed	Logbook 1(2),	Not Logged(1), Logbook 2(3)		R/W	4, 72	unsigned8 (1)
temperature coefficient	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 73	unsigned8 (1)
input 1 imp after cal	Logbook 1(2),	Not Logged(1), Logbook 2(3)		R/W	4, 74	unsigned8 (1)
input 2 imp after cal	Logbook 1(2),	Not Logged(1), Logbook 2(3)		R/W	4, 75	unsigned8 (1)
delta ph changed	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 76	unsigned8 (1)
delta t changed	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 77	unsigned8 (1)
isothermal point changed	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 78	unsigned8 (1)
zeropoint changed	Logbook 1(2),	Not Logged(1), Logbook 2(3)		R/W	4, 79	unsigned8 (1)
new sensor installed	Logbook 1(2),	Not Logged(1), Logbook 2(3)		R/W	4, 80	unsigned8 (1)
one point calibration	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 81	unsigned8 (1)
two point calibration	Not Logged(1),	Logbook 1(2), Logbook 2(3)		R/W	4, 82	unsigned8 (1)
Buffer Solution 1						
Buffer1 ID	4.00			R/W	4, 105	unsigned8 (1)
Buffer1 at 0°C	4.00			R/W	4, 106	float (4)
Buffer1 at 5°C	4.00			R/W	4, 107	float (4)
Buffer1 at 10°C	4.00			R/W	4, 108	float (4)
Buffer1 at 15°C	4.00			R/W	4, 109	float (4)

4-4-3-1. Transducer block parameters PH202 (continued)

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Buffer1 at 20°C	4.00			R/W	4, 110	float (4)
Buffer1 at 25°C	4.01			R/W	4, 111	float (4)
Buffer1 at 30°C	4.02			R/W	4, 112	float (4)
Buffer1 at 35°C	4.02			R/W	4, 113	float (4)
Buffer1 at 40°C	4.04			R/W	4, 114	float (4)
Buffer1 at 45°C	4.05			R/W	4, 115	float (4)
Buffer1 at 50°C	4.06			R/W	4, 116	float (4)
Buffer1 at 55°C	4.08			R/W	4, 117	float (4)
Buffer1 at 60°C	4.09			R/W	4, 118	float (4)
Buffer1 at 65°C	4.11			R/W	4, 119	float (4)
Buffer1 at 70°C	4.13			R/W	4, 120	float (4)
Buffer1 at 75°C	4.15			R/W	4, 121	float (4)
Buffer1 at 80°C	4.16			R/W	4, 122	float (4)
Buffer Solution 2						
Buffer2 ID	7.00			R/W	4, 123	unsigned8 (1)
Buffer2 at 0°C	6.98			R/W	4, 124	float (4)
Buffer2 at 5°C	6.95			R/W	4, 125	float (4)
Buffer2 at 10°C	6.92			R/W	4, 126	float (4)
Buffer2 at 15°C	6.90			R/W	4, 127	float (4)
Buffer2 at 20°C	6.88			R/W	4, 128	float (4)
Buffer2 at 25°C	6.87			R/W	4, 129	float (4)
Buffer2 at 30°C	6.85			R/W	4, 130	float (4)
Buffer2 at 35°C	6.84			R/W	4, 131	float (4)
Buffer2 at 40°C	6.84			R/W	4, 132	float (4)
Buffer2 at 45°C	6.83			R/W	4, 133	float (4)
Buffer2 at 50°C	6.83			R/W	4, 134	float (4)
Buffer2 at 55°C	6.83			R/W	4, 135	float (4)
Buffer2 at 60°C	6.84			R/W	4, 136	float (4)
Buffer2 at 65°C	6.84			R/W	4, 137	float (4)
Buffer2 at 70°C	6.85			R/W	4, 138	float (4)
Buffer2 at 75°C	6.85			R/W	4, 139	float (4)
Buffer2 at 80°C	6.86			R/W	4, 140	float (4)
Buffer Solution 3						
Buffer3 ID	9			R/W	4, 141	unsigned8 (1)
Buffer3 at 0°C	9.46			R/W	4, 142	float (4)
Buffer3 at 5°C	9.40			R/W	4, 143	float (4)
Buffer3 at 10°C	9.33			R/W	4, 144	float (4)
Buffer3 at 15°C	9.28			R/W	4, 145	float (4)
Buffer3 at 20°C	9.23			R/W	4, 146	float (4)
Buffer3 at 25°C	9.18			R/W	4, 147	float (4)
Buffer3 at 30°C	9.14			R/W	4, 148	float (4)
Buffer3 at 35°C	9.10			R/W	4, 149	float (4)
Buffer3 at 40°C	9.07			R/W	4, 150	float (4)
Buffer3 at 40°C	9.04			R/W	4, 151	float (4)
Buffer3 at 50°C	9.01			R/W	4, 152	float (4)
Buffer3 at 55°C	8.99			R/W	4, 153	float (4)
Buffer3 at 60°C	8.96			R/W	4, 154	float (4)
Buffer3 at 65°C	8.94			R/W	4, 155	float (4)
Buffer3 at 70°C	8.92			R/W	4, 156	float (4)
Buffer3 at 75°C	8.90			R/W	4, 157	float (4)
Buffer3 at 80°C	8.89			R/W	4, 158	float (4)

4-4-3-2. Function Block Parameters SC202

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Primary Value Parameters						
Primary value Type	Conductivity(113)	conductivity(113), resistivity(116)		R	4, 27	unsigned16 (2)
Measured Value			S/cm		4, 28	
Status					4, 28	
Conductivity sensor type	2 electrode(146)	contact 2-electrode(146), contact 4-electrode(163)		R/W	4, 42	unsigned16 (2)
Secondary Value Parameters						
Value		-20~250, 0~500	°C	R	4, 36	DS-33 (5)
Status					4, 36	
Secondary value unit	°C(1001)	°C(1001), °F(1002)		R/W	4, 37	unsigned16 (2)
Sensor temp comp	Automatic(3)	auto(3)		R	4, 38	unsigned8 (1)
Sensor temp man value	25	0	°C	R	4, 39	float (4)
Temperature sensor	Pt1000(148)	Pt1000(148), Pt100(128), Ni100(149), 8k55(151), Pb36/JIS6k(152)		R/W	4, 40	unsigned16 (2)
Temp. connection type	2	2		R	4, 41	unsigned8 (1)
Tertiary Value Parameters						
Value			S/cm	R	4, 47	DS-33 (5)
Status					4, 47	
Compensation Parameters						
Reference temperature	25	0~100, 32~212	°C	R/W	4, 48	float (4)
Compensation method	NaCl(1)	NaCl(1), TC(2), matrix(3)		R/W	4, 49	unsigned8 (1)
Temperature coefficient	2.1	0~3.5	%/°C	R/W	4, 45	float (4)
Matrix selection		HCl cation(1), Ammonia pure water(2), Morpholine pure water(3), HCl 0-5%(4), Natrium hydroxide 0-5%, user defined(9)		R/W	4, 50	unsigned8 (1)
Tertiary comp. method	NaCl(1)	NaCl(1), TC(2), matrix(3)		R/W	4, 51	unsigned8 (1)
Tertiary temp. coefficient	2.1	0~3.5		R/W	4, 52	float (4)
Concentration Parameters						
Concentration value	0			R	4, 46	DS-33 (5)
Concentration status					4, 46	
Concentration Measurement	Disabled(1)	Enabled(2)			4, 120	unsigned8(1)
Concentration 0%	0	0~100	%	R/W	4, 121	float (4)
Concentration 100%	100	0~100	%	R/W	4, 122	float (4)
Concentration Table 0%	0	0~1.999, 0~999MΩ•cm	S/cm	R/W	4, 123	float (4)
Concentration Table 5%	0.00005		S/cm	R/W	4, 124	float (4)
Concentration Table 10%	0.0001		S/cm	R/W	4, 125	float (4)
Concentration Table 15%	0.00015		S/cm	R/W	4, 126	float (4)
Concentration Table 20%	0.0002		S/cm	R/W	4, 127	float (4)
Concentration Table 25%	0.00025		S/cm	R/W	4, 128	float (4)
Concentration Table 30%	0.0003		S/cm	R/W	4, 129	float (4)
Concentration Table 35%	0.00035	0~1.999, 0~999MΩ•cm	S/cm	R/W	4, 130	float (4)
Concentration Table 40%	0.0004		S/cm	R/W	4, 131	float (4)
Concentration Table 45%	0.00045		S/cm	R/W	4, 132	float (4)
Concentration Table 50%	0.0005		S/cm	R/W	4, 133	float (4)
Concentration Table 55%	0.00055		S/cm	R/W	4, 134	float (4)
Concentration Table 60%	0.0006		S/cm	R/W	4, 135	float (4)
Concentration Table 65%	0.00065		S/cm	R/W	4, 136	float (4)
Concentration Table 70%	0.0007	0~1.999, 0~999MΩ•cm	S/cm	R/W	4, 137	float (4)
Concentration Table 75%	0.00075		S/cm	R/W	4, 138	float (4)
Concentration Table 80%	0.0008		S/cm	R/W	4, 139	float (4)
Concentration Table 85%	0.00085		S/cm	R/W	4, 140	float (4)
Concentration Table 90%	0.0009		S/cm	R/W	4, 141	float (4)
Concentration Table 95%	0.00095		S/cm	R/W	4, 142	float (4)
Concentration Table 100%	0.001		S/cm	R/W	4, 143	float (4)

4-4-3-2. Function Block Parameters SC202 (continued)

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Calibration Parameters						
Nominal cell constant	0.1	0.005~50	1/cm	R/W	4, 30	float (4)
Calibrated cell constant	0.1	0.005~50	1/cm	R	4, 89	float (4)
Calibration method	Not calibrated(0)	1 point(107), 2 point(108)		R/W	4, 34	unsigned8 (1)
Diagnostic Settings						
Polarisation check	Enabled(1)	Disable(0)			4, 151(2.1)	
Polarization detected (E1)	Hard fail(1)	Soft fail(0)			4, 150(2.0)	
E5 Limit	0.25	0~0.5, 0~10MΩ	S	R/W	4, 144	float (4)
E6 Limit	0.000001	0~0.5, 0~10MΩ	S	R/W	4, 145	float (4)
Conductivity exceeds high limit (E5)	Hard fail(1)	Soft fail(0)			4, 150(2.4)	
Conductivity exceeds low limit (E6)	Hard fail(1)	Soft fail(0)			4, 150(2.5)	
Temp. sensor open (E7)	Hard fail(1)	Soft fail(0)			4, 150(2.6)	
Temp. sensor shorted (E8)	Hard fail(1)	Soft fail(0)			4, 150(2.7)	
USP	Disabled					
Conductivity exceeds USP limit (E13)	Soft fail(0)	Hard fail(1)		R/W	4, 150(1.4)	unsigned32 (4)
Passcode Configuration						
Passcode Maintenance	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 147	unsigned16 (2)
Passcode Commissioning	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 148	unsigned16 (2)
Passcode Service	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 149	unsigned16 (2)
Display Settings						
Display Resolution	Auto Ranging(1)	auto(1), x.xxx µS/cm(2), xx.xx µS/cm(3) xxx.x µS/cm(4), x.xxx mS/cm(5), xx.xx mS/cm(6) xxx.x mS/cm(7), xxxx mS/cm(8)		R	4, 146	unsigned8 (1)
Auto return	Enabled(1)	Disable(0)		R	4, 151(1.0)	
Logbook Configuration						
Power up	Logbook 2(3)	off(1), logbook1(2), logbook2(3)		R/W	4, 59	unsigned8 (1)
Power down	Logbook 2(3)			R/W	4, 60	unsigned8 (1)
System error	Logbook 1(2)			R/W	4, 61	unsigned8 (1)
Defaults loaded	Not logged(1)			R/W	4, 62	unsigned8 (1)
Logbook erased	Not logged(1)			R/W	4, 63	unsigned8 (1)
Init performed	Logbook 1(2)			R/W	4, 64	unsigned8 (1)
Error on	Not logged(1)			R/W	4, 65	unsigned8 (1)
Error off	Not logged(1)			R/W	4, 66	unsigned8 (1)
Temperature adjust	Logbook 1(2)			R/W	4, 67	unsigned8 (1)
Cell constant	Logbook 1(2)			R/W	4, 68	unsigned8 (1)
Air calibration	Logbook 1(2)			R/W	4, 69	unsigned8 (1)
Calibration	Logbook 1(2)			R/W	4, 70	unsigned8 (1)
Reference temperature	Not logged(1)			R/W	4, 71	unsigned8 (1)
Temperature coefficient 1	Not logged(1)			R/W	4, 72	unsigned8 (1)
Matrix selection	Not logged(1)			R/W	4, 73	unsigned8 (1)
Temperature coefficient 2	Not logged(1)			R/W	4, 74	unsigned8 (1)
User defined matrix						
Temperature 1	0	-20~250, 0~500	°C	R/W	4, 90	float (4)
Temperature 2	25		°C	R/W	4, 91	float (4)
Temperature 3	50		°C	R/W	4, 92	float (4)
Temperature 4	75		°C	R/W	4, 93	float (4)
Temperature 5	100		°C	R/W	4, 94	float (4)
Solution 1 at Temp. 1	0.031	0~1.999, 0~999MΩ•cm	S/cm	R/W	4, 95	float (4)
Solution 1 at Temp. 2	0.053		S/cm	R/W	4, 96	float (4)
Solution 1 at Temp. 3	0.076		S/cm	R/W	4, 97	float (4)
Solution 1 at Temp. 4	0.0975		S/cm	R/W	4, 98	float (4)
Solution 1 at Temp. 5	0.119		S/cm	R/W	4, 99	float (4)
Solution 2 at Temp. 1	0.061	0~1.999, 0~999MΩ•cm	S/cm	R/W	4, 100	float (4)

4-4-3-2. Function Block Parameters SC202 (continued)

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Solution 2 at Temp. 2	0.101		S/cm	R/W	4, 101	float (4)
Solution 2 at Temp. 3	0.141		S/cm	R/W	4, 102	float (4)
Solution 2 at Temp. 4	0.182		S/cm	R/W	4, 103	float (4)
Solution 2 at Temp. 5	0.223		S/cm	R/W	4, 104	float (4)
Solution 3 at Temp. 1	0.086	0~1.999, 0~999MΩ•cm	S/cm	R/W	4, 105	float (4)
Solution 3 at Temp. 2	0.145		S/cm	R/W	4, 106	float (4)
Solution 3 at Temp. 3	0.207		S/cm	R/W	4, 107	float (4)
Solution 3 at Temp. 4	0.264		S/cm	R/W	4, 108	float (4)
Solution 3 at Temp. 5	0.318		S/cm	R/W	4, 109	float (4)
Solution 4 at Temp. 1	0.105	0~1.999, 0~999MΩ•cm	S/cm	R/W	4, 110	float (4)
Solution 4 at Temp. 2	0.185		S/cm	R/W	4, 111	float (4)
Solution 4 at Temp. 3	0.286		S/cm	R/W	4, 112	float (4)
Solution 4 at Temp. 4	0.339		S/cm	R/W	4, 113	float (4)
Solution 4 at Temp. 5	0.41		S/cm	R/W	4, 114	float (4)
Solution 5 at Temp. 1	0.127	0~1.999, 0~999MΩ•cm	S/cm	R/W	4, 115	float (4)
Solution 5 at Temp. 2	0.223		S/cm	R/W	4, 116	float (4)
Solution 5 at Temp. 3	0.319		S/cm	R/W	4, 117	float (4)
Solution 5 at Temp. 4	0.408		S/cm	R/W	4, 118	float (4)
Solution 5 at Temp. 5	0.495		S/cm	R/W	4, 119	float (4)

4-4-3-3. Function Block Parameters ISC202

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Primary Value Parameters						
Primary value Type	Conductivity(113)	conductivity(113), resistivity(116)		R	4, 27	unsigned16 (2)
Measured Value			S/cm		4, 28	
Status					4, 28	
Conductivity sensor type	toroidal(147)			R/W	4, 42	unsigned16 (2)
Secondary Value Parameters						
Value		-20~140, 0~280	°C	R	4, 36	DS-33 (5)
Status					4, 36	
Secondary value unit	°C(1001)	°C(1001), °F(1002)		R/W	4, 37	unsigned16 (2)
Sensor temp comp	Automatic(3)	auto(3)		R	4, 38	unsigned8 (1)
Sensor temp man value	25	0	°C	R	4, 39	float (4)
Temperature sensor	NTC30k(154)	Pt1000(148)		R/W	4, 40	unsigned16 (2)
Temp. connection type	2	2		R	4, 41	unsigned8 (1)
Tertiary Value Parameters						
Value			S/cm	R	4, 47	DS-33 (5)
Status					4, 47	
Compensation Parameters						
Reference temperature	25	0~100, 32~212	°C	R/W	4, 48	float (4)
Compensation method	NaCl(1)	NaCl(1), TC(2), matrix(3)		R/W	4, 49	unsigned8 (1)
Temperature coefficient	2.1	0~3.5		R/W	4, 45	float (4)
Matrix selection		H_2SO_4 0.5-5.0%, 0-100ºC(1), 2.5-25%, 0-100ºC(2) HCl 0-5%, 0-60ºC(3), 1-20%, 0-60ºC(4) HNO3 0.5-5.0%, 0-80ºC(5), 2.5-25%, 0-80ºC(6) NaOH 0.5-5.0%, 0-100ºC(7), 0.5-15%, 0-100ºC(8) user defined(9)		R/W	4, 50	unsigned8 (1)
Tertiary comp. method	NaCl(1)	NaCl(1), TC(2), matrix(3)		R/W	4, 51	unsigned8 (1)
Tertiary temp. coefficient	2.1	0~3.5		R/W	4, 52	float (4)
Concentration Parameters						
Concentration value	0		%/°C	R	4, 46	DS-33 (5)
Concentration status					4, 46	
Concentration Measurement	Disabled(1)	Enabled(2)	%		4, 120	unsigned 8 (1)

4-4-3-3. Function Block Parameters ISC202 (continued)

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Concentration 0%	0	0~100	%	R/W	4, 121	float (4)
Concentration 100%	100	0~100	%	R/W	4, 122	float (4)
Concentration Table 0%	0	0~1.999	S/cm	R/W	4, 123	float (4)
Concentration Table 5%	0.05		S/cm	R/W	4, 124	float (4)
Concentration Table 10%	0.1		S/cm	R/W	4, 125	float (4)
Concentration Table 15%	0.15		S/cm	R/W	4, 126	float (4)
Concentration Table 20%	0.2		S/cm	R/W	4, 127	float (4)
Concentration Table 25%	0.25		S/cm	R/W	4, 128	float (4)
Concentration Table 30%	0.3		S/cm	R/W	4, 129	float (4)
Concentration Table 35%	0.35	0~1.999	S/cm	R/W	4, 130	float (4)
Concentration Table 40%	0.4		S/cm	R/W	4, 131	float (4)
Concentration Table 45%	0.45		S/cm	R/W	4, 132	float (4)
Concentration Table 50%	0.5		S/cm	R/W	4, 133	float (4)
Concentration Table 55%	0.55		S/cm	R/W	4, 134	float (4)
Concentration Table 60%	0.6		S/cm	R/W	4, 135	float (4)
Concentration Table 65%	0.65		S/cm	R/W	4, 136	float (4)
Concentration Table 70%	0.7	0~1.999	S/cm	R/W	4, 137	float (4)
Concentration Table 75%	0.75		S/cm	R/W	4, 138	float (4)
Concentration Table 80%	0.8		S/cm	R/W	4, 139	float (4)
Concentration Table 85%	0.85		S/cm	R/W	4, 140	float (4)
Concentration Table 90%	0.9		S/cm	R/W	4, 141	float (4)
Concentration Table 95%	0.95		S/cm	R/W	4, 142	float (4)
Concentration Table 100%	1		S/cm	R/W	4, 143	float (4)
Calibration Parameters						
Nominal cell constant	1.88	0.005~50	1/cm	R/W	4, 30	float (4)
Calibrated cell constant	0.1	0.005~50	1/cm	R	4, 89	float (4)
Calibration method	Not calibrated(0)	1 point(107), 2 point(108)		R/W	4, 34	unsigned8 (1)
Diagnostic Settings						
E5 Limit	3	0~0.5Ω	S	R/W	4, 144	float (4)
E6 Limit	0.000005	0~0.5Ω	S	R/W	4, 145	float (4)
Conductivity exceeds high limit (E5)	Hard fail(1)	Soft fail(0)			4, 150(2.4)	
Conductivity exceeds low limit (E6)	Hard fail(1)	Soft fail(0)			4, 150(2.5)	
Temp. sensor open (E7)	Hard fail(1)	Soft fail(0)			4, 150(2.6)	
Temp. sensor shorted (E8)	Hard fail(1)	Soft fail(0)			4, 150(2.7)	
Passcode Configuration						
Passcode Maintenance	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 147	unsigned16 (2)
Passcode Commissioning	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 148	unsigned16 (2)
Passcode Service	0	0, 111, 333, 777, 888, 123, 957, 331, 546, 847		R/W	4, 149	unsigned16 (2)
Display Settings						
Display Resolution	Auto Ranging(1)	auto(1), xxx.x µS/cm(4) x.xxx mS/cm(5), xx.xx mS/cm(6) xxx.x mS/cm(7), xxxx mS/cm(8)		R	4, 146	unsigned8 (1)
Auto return	Enabled(1)	Disable(0)		R	4, 151(1.0)	
Logbook Configuration						
Power up	Logbook 2(3)	off(1), logbook1(2), logbook2(3)		R/W	4, 59	unsigned8 (1)
Power down	Logbook 2(3)			R/W	4, 60	unsigned8 (1)
System error	Logbook 1(2)			R/W	4, 61	unsigned8 (1)
Defaults loaded	Not logged(1)			R/W	4, 62	unsigned8 (1)
Logbook erased	Not logged(1)			R/W	4, 63	unsigned8 (1)
Init performed	Logbook 1(2)			R/W	4, 64	unsigned8 (1)
Error on	Not logged(1)			R/W	4, 65	unsigned8 (1)
Error off	Not logged(1)			R/W	4, 66	unsigned8 (1)
Temperature adjust	Logbook 1(2)			R/W	4, 67	unsigned8 (1)
Cell constant	Logbook 1(2)			R/W	4, 68	unsigned8 (1)
Air calibration	Logbook 1(2)			R/W	4, 69	unsigned8 (1)

4-4-3-3. Function Block Parameters ISC202 (continued)

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Calibration	Logbook 1(2)			R/W	4, 70	unsigned8 (1)
Reference temperature	Not logged(1)			R/W	4, 71	unsigned8 (1)
Temperature coefficient 1	Not logged(1)			R/W	4, 72	unsigned8 (1)
Matrix selection	Not logged(1)			R/W	4, 73	unsigned8 (1)
Temperature coefficient 2	Not logged(1)			R/W	4, 74	unsigned8 (1)
User defined matrix						
Temperature 1	0	-20~140, 0~280	°C	R/W	4, 90	float (4)
Temperature 2	25		°C	R/W	4, 91	float (4)
Temperature 3	50		°C	R/W	4, 92	float (4)
Temperature 4	75		°C	R/W	4, 93	float (4)
Temperature 5	100		°C	R/W	4, 94	float (4)
Solution 1 at Temp. 1	0.0338	0~1.999	S/cm	R/W	4, 95	float (4)
Solution 1 at Temp. 2	0.0470		S/cm	R/W	4, 96	float (4)
Solution 1 at Temp. 3	0.0575		S/cm	R/W	4, 97	float (4)
Solution 1 at Temp. 4	0.0637		S/cm	R/W	4, 98	float (4)
Solution 1 at Temp. 5	0.0680		S/cm	R/W	4, 99	float (4)
Solution 2 at Temp. 1	0.0635	0~1.999	S/cm	R/W	4, 100	float (4)
Solution 2 at Temp. 2	0.0923		S/cm	R/W	4, 101	float (4)
Solution 2 at Temp. 3	0.1120		S/cm	R/W	4, 102	float (4)
Solution 2 at Temp. 4	0.1260		S/cm	R/W	4, 103	float (4)
Solution 2 at Temp. 5	0.1380		S/cm	R/W	4, 104	float (4)
Solution 3 at Temp. 1	0.0950	0~1.999	S/cm	R/W	4, 105	float (4)
Solution 3 at Temp. 2	0.1350		S/cm	R/W	4, 106	float (4)
Solution 3 at Temp.3	0.1660		S/cm	R/W	4, 107	float (4)
Solution 3 at Temp.4	0.1890		S/cm	R/W	4, 108	float (4)
Solution 3 at Temp. 5	0.2060		S/cm	R/W	4, 109	float (4)
Solution 4 at Temp. 1	0.1240	0~1.999	S/cm	R/W	4, 110	float (4)
Solution 4 at Temp. 2	0.1780		S/cm	R/W	4, 111	float (4)
Solution 4 at Temp. 3	0.2200		S/cm	R/W	4, 112	float (4)
Solution 4 at Temp. 4	0.2490		S/cm	R/W	4, 113	float (4)
Solution 4 at Temp. 5	0.2730		S/cm	R/W	4, 114	float (4)
Solution 5 at Temp. 1	0.1540	0~1.999	S/cm	R/W	4, 115	float (4)
Solution 5 at Temp. 2	0.2180		S/cm	R/W	4, 116	float (4)
Solution 5 at Temp. 3	0.2700		S/cm	R/W	4, 117	float (4)
Solution 5 at Temp. 4	0.3070		S/cm	R/W	4, 118	float (4)
Solution 5 at Temp. 5	0.3360		S/cm	R/W	4, 119	float (4)

4-4-3-4. Function Block Parameters DO202

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Primary value parameters						
Primary value Type	dissolved oxyg. (65520)		R	4,27	unsigned16	(2)
Measured Value			ppm	R	4,28	DS-33 (5)
Status				R	4,28	DS-33 (5)
Sensor type DO	polarographic (2)	galvanic (1)		R/W	4,31	unsigned16 (2)
Primary value unit	ppm (1423)	% saturation (1342), ppb (1424)		R	4,30	unsigned16 (2)
Secondary Value Parameters						
Value			°C	R	4,43	DS-33 (5)
Status				R	4,43	DS-33 (5)
Secondary value unit	°C (1001)	°F (1002)		R/W	4,44	unsigned16 (2)
Sensor temp comp	auto (2)	manual (1)		R/W	4,45	unsigned8 (1)
Sensor temp man value	25		°C	R/W	4,46	float (4)
Temperature sensor	NTC22k (160)	Pt1000 (148), Pb36 (152)		R/W	4,47	unsigned16 (2)
Other Value Parameters						
Sensor current			nA	R	4,49	float (4)
%Saturation			%	R	4,50	float (4)
Calibration Parameters						
Zero calibration	disabled (0)	enabled (1)		R/W	4,97 (1.0)	unsigned32 (4)
Zero current	0.0	-199.9 ~ 199.9	nA	R/W	4,33	float (4)
Zero current limit	199.9		nA	R/W	4,51	float (4)
Sensitivity	7.5	1.0 ~ 1999.9	nA/ ppm	R/W	4,34	float (4)
Stable time	60	5 ~ 600	s	R/W	4,35	float (4)
Stable value (sensitivity)	0.1	0 ~ 50.0	ppm	R/W	4,36	float (4)
Stable value (zero)	0.1	0 ~ 50.0	ppm	R/W	4,37	float (4)
Calibration pressure	101.3 (kPa)	0 ~ 999	kPa	R/W	4,39	float (4)
Compensation Parameters						
Salinity compensation	disabled (0)	enabled (1)		R/W	4,97 (1.4)	unsigned32 (4)
Salinity	0.0	0 ~ 99.9	ppt	R/W	4,38	float (4)
%Saturation pressure	101.3 (kPa)	0 ~ 999	kPa	R/W	4,41	float (4)
Diagnostic Settings						
Calibration not stable (E1)	Hard fail (1)	Soft fail (0)		R/W	4,96 (1.0)	unsigned32 (4)
Zero out of limits (E2)	Hard fail (1)	Soft fail (0)		R/W	4,96 (1.1)	unsigned32 (4)
Temp. sensor open (E7)	Hard fail (1)	Soft fail (0)		R/W	4,96 (1.6)	unsigned32 (4)
Temp. sensor shorted (E8)	Hard fail (1)	Soft fail (0)		R/W	4,96 (1.7)	unsigned32 (4)
Primary value exceeds limits (E9)	Hard fail (1)	Soft fail (0)		R/W	4,96 (2.0)	unsigned32 (4)
Calibr. timer expired (E16)	Soft fail (0)	Hard fail (1)		R/W	4,96 (2.7)	unsigned32 (4)
Passcode Configuration						
Passcode Maintenance	000	111,333,777,888,123,957,331,546,847		R/W	4,62	float (4)
Passcode Commisioning	000	111,333,777,888,123,957,331,546,848		R/W	4,63	float (4)
Passcode Service	000	111,333,777,888,123,957,331,546,849		R/W	4,64	float (4)
Display Settings						
Manual pressure in maintenance menu	disabled (0)	enabled (1)		R/W	4,97 (1.7)	unsigned32 (4)
Auto return	enabled (1)	disabled (0)		R/W	4,97 (1.3)	unsigned32 (4)
Logbook Configuration						
Power up	logbook2 (3)	not logged (1), logbook1 (2)		R/W	4,69	unsigned8 (1)
Power down	logbook2 (3)	not logged (1), logbook1 (2)		R/W	4,70	unsigned8 (1)
System error	logbook1 (2)	-		R	4,71	unsigned8 (1)
Defaults loaded	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,72	unsigned8 (1)
Logbook erased	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,73	unsigned8 (1)
Init performed	logbook1 (2)	-		R	4,74	unsigned8 (1)
Error on	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,75	unsigned8 (1)
Error off	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,76	unsigned8 (1)
Temperature adjust	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,77	unsigned8 (1)

4-4-3-4. Function Block Parameters DO202 (continued)

Parameter	Default	Alternatives	Unit	R/W	Slot, Index (byte,bit)	Data Type (bytes)
Manual temperature	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,78	unsigned8 (1)
Manual calibration (0%)	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,83	unsigned8 (1)
Manual calibration (100%)	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,79	unsigned8 (1)
Air calibration (0%)	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,92	unsigned8 (1)
Air calibration (100%)	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,80	unsigned8 (1)
H_2O calibration (0%)	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,82	unsigned8 (1)
H_2O calibration (100%)	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,81	unsigned8 (1)
Zero setting changed	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,84	unsigned8 (1)
Sensitivity changed	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,90	unsigned8 (1)
Delta t for calibation changed	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,86	unsigned8 (1)
Delta PV for calibration changed (0%)	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,85	unsigned8 (1)
Delta PV for calibration changed (100%)	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,91	unsigned8 (1)
Salinity compensation changed	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,87	unsigned8 (1)
%Saturation pressure changed	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,88	unsigned8 (1)
Calibration pressure changed	not logged (1)	logbook1 (2), logbook2 (3)		R/W	4,89	unsigned8 (1)
New sensor installed	logbook1 (2)	not logged (1), logbook2 (3)		R/W	4,93	unsigned8 (1)

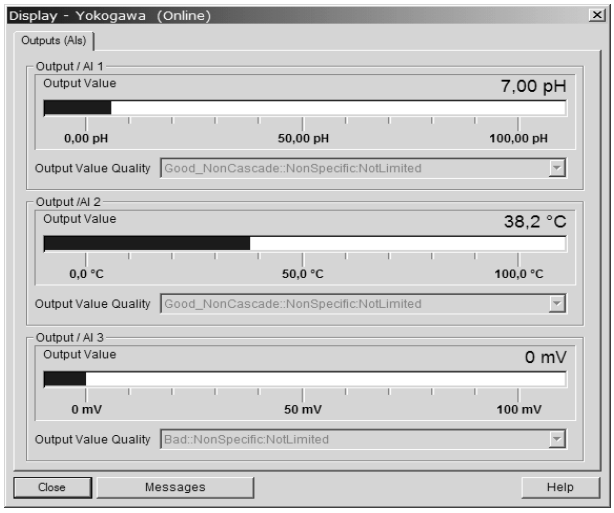
4-4-4 Methods

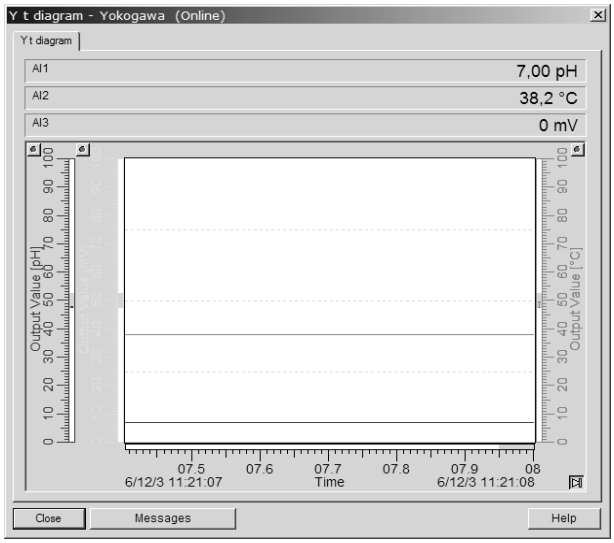
The EXA supports methods. A method is a tool to provide the user with a “step by step” user interface for changing settings and providing information.

The following screendumps are derived from a Siemens PDM package.

Display and Y-t diagram methods

The EXA provides three process values simultaneously. These can be viewed with the display method for bargraphs or with Y-t diagram.

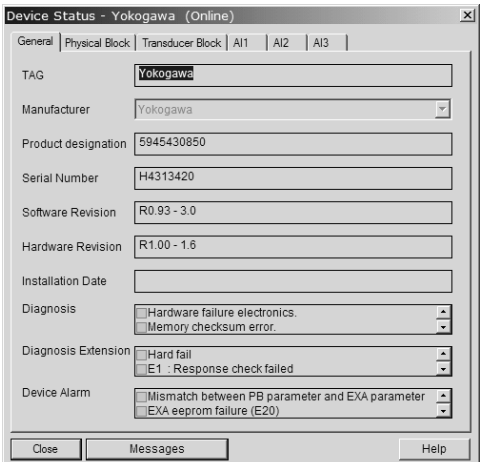




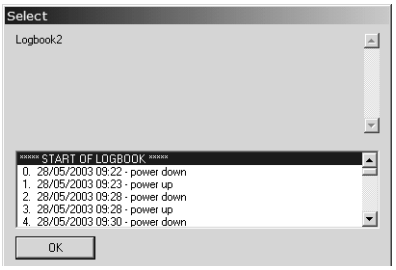
Clock method

This method can be used to set the time of the EXA.

Status method
This method can be used to obtain general information of the EXA like serial number and software revision. This method also provides the user with the current status of the EXA. This can be usefull when the EXA shows errors.



Logbook method
One of the powerfull features of the EXA is the logbook functionality. All events can be stored in one of the two logbooks. To read (upload) the logbook information, simply use this method and the user is provided with all stored events. Each logbook can obtain up to 50 events.



APPENDIX 1. LINK MASTER FUNCTIONS

A1-1 Link Active Scheduler

A link active scheduler (LAS) is a deterministic, centralized bus scheduler that can control communications on an H1 fieldbus segment. There is only one LAS on an H1 fieldbus segment.
A EXA202 supports the following LAS functions.

- PN transmission: Identifies a fieldbus device newly connected to the same fieldbus segment. PN is short for Probe Node.
- PT transmission: Passes a token governing the right to transmit, to a fieldbus device on the same segment. PT is short for Pass Token.
- CD transmission: Carry out a scheduled transmission to a fieldbus device on the same segment. CD is short for Compel Data.
- Time synchronization: Periodically transmits the time data to all fieldbus devices on the segment and returns the time data in response to a request from a device.
- Live list equalization: Sends the live list data to link masters on the same segment.
- LAS transfer: Transfers the right to be the LAS on the segment to another link master.

A1-2 Link Master

A link master (LM) is any device containing a link active scheduler. There must be at least one LM on a segment. When the LAS on a segment has failed, another LM on the same segment starts working as the LAS.

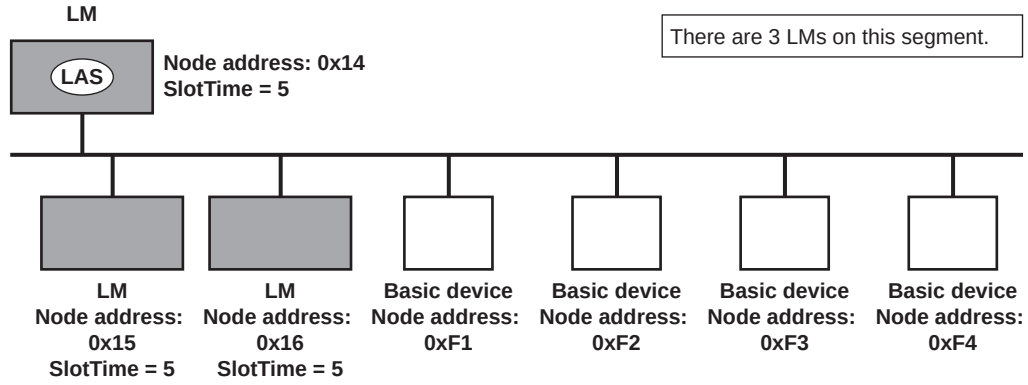


Figure A1-1. Example of Fieldbus configuration-3 LMs on Same Segment

A1-3 Transfer of LAS

There are two procedures for an LM to become the LAS:

- If the LM whose value of [V(ST)3V(TN)] is the smallest on a segment, with the exception of the current LAS, judges that there is no LAS on the segment, in such a case as when the segment has started up or when the current LAS has failed, the LM declares itself as the LAS, then becomes the LAS. (With this procedure, an LM backs up the LAS as shown in the following figure.)
- The LM whose value of [V(ST)3V(TN)] is the smallest on a segment, with the exception of the current LAS, requests the LAS on the same segment to transfer the right of being the LAS, then becomes the LAS.

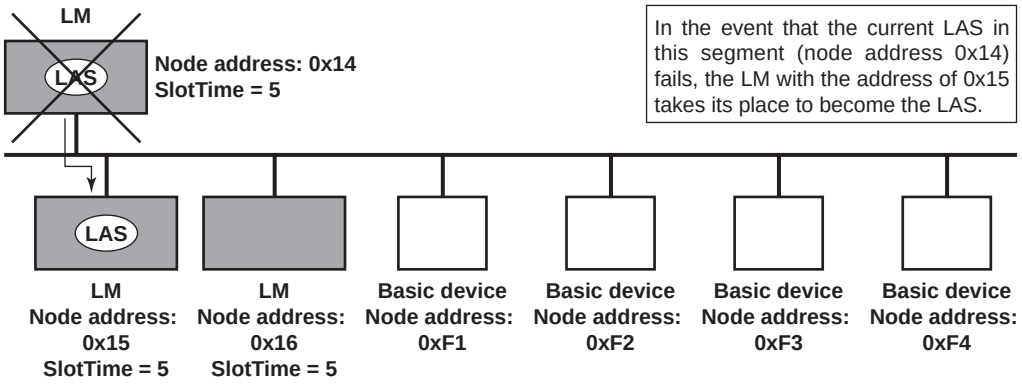


Figure A1-2. Backup of LAS

To set up a EXA202 as a device that is capable of backing up the LAS, follow the procedure below.

NOTE: When changing the settings in a EXA202, add the EXA202 to the segment in which an LAS is running. After making changes to the settings, do not turn off the power to the EXA202 for at least 60 seconds.

(1) Set the node address of the EXA202. In general, use an address from 0x14 to [V(FUN) – 1].

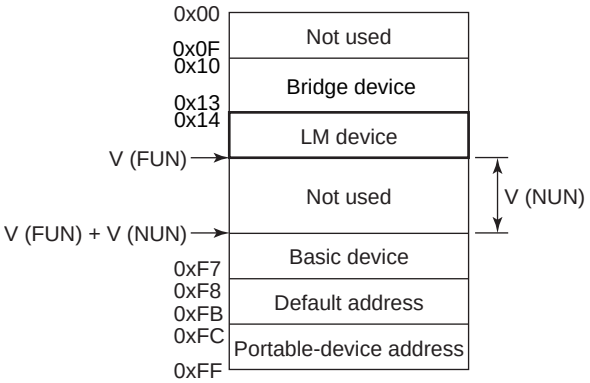


Figure A1-3. Node Address Ranges

(2) In the LAS settings of the EXA202, set the values of V(ST), V(MRD), and V(MID) to the same as the respective lowest capability values in all the devices within the segment. An example is shown below.

DlmeBasicInfo (EXA202 Index 361 (SM))

Sub-index	Element	EXA202	Device 1	Device 2	Device 3	Description
1	SlotTime	4	8	10	20	Capability value for V(ST)
3	MaxResponse Delay	3	6	3	5	Capability value for V(MRD)
6	MinInterPdu Delay	4	8	12	10	Capability value for V(MID)

In this case, set SlotTime, MaxResponseTime, and MinInterPduDelay as follows:

ConfiguredLinkSettingsRecord (EXA202 Index 369 (SM))

Subindex	Element	Setting (Default)	Description
1	SlotTime	20 (4095)	V (ST)
3	MaxResponseDelay	6 (5)	V (MRD)
6	MinInterPduDelay	12 (12)	V (MID)

(3) In the LAS settings of the EXA202, set the values of V(FUN) and V(NUN) so that they include the node addresses of all nodes within the same segment. (See also Figure A1-3.)

ConfiguredLinkSettingsRecord
(EXA202 Index 369 (SM))

Subindex	Element	Default Value	Description
4	FirstUnpolledNodeId	0x25	V (FUN)
7	NumConsecUnpolledNodeId	0xBA	V (NUN)

A1-4 LM Functions

No.	Function	Description
1	LM initialization	When a fieldbus segment starts, the LM with the smallest [V(ST) × V(TN)] value within the segment becomes the LAS. At all times, each LM is checking whether or not a carrier is on the segment.
2	Startup of other nodes (PN and Node Activation SPDU transmissions)	Transmits a PN (Probe Node) message, and Node Activation SPDU message to devices which return a new PR (Probe Response) message.
3	PT transmission (including final bit monitoring)	Passes a PT (Pass Token) message to devices included in the live list sequentially, and monitors the RT (Return Token) and final bit returned in reply to the PT.
4	CD transmission	Transmits a CD (Compel Data) message at the scheduled times.
5	Time synchronization	Supports periodic TD (Time Distribution) transmissions and transmissions of a reply to a CT (Compel Time).
6	Domain download server	Sets the schedule data. The schedule data can be equalized only when the Domain Download command is carried out from outside the LM in question. (The version of the schedule is usually monitored, but no action takes place, even when it changes.)
7	Live list equalization	Transmits SPDU messages to LMs to equalize live lists.
8	LAS transfer	Transfers the right of being the LAS to another LM.
9	Reading/writing of NMIB for LM	See Section A1-5.
10	Round Trip Delay Reply (RR) Reply to DLPDU	Not yet supported in the current version.
11	Long address	Not yet supported in the current version.

A1-5 LM Parameters

A1-5-1 LM Parameter List

The tables below show LM parameters of a EXA202.

Meanings of **Access** column entries: RW = read/write possible; R = read only

Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
362	DLME_LINK_MASTER_CAPABILITIES_VARIABLE		0x04	RW	
363	DLME_LINK_MASTER_INFO_RECORD	0		RW	
		1 MaxSchedulingOverhead	0		
		2 DefMinTokenDelegTime	100		
		3 DefTokenHoldTime	300		
		4 TargetTokenRotTime	4096		
		5 LinkMaintTokHoldTime	400		
		6 TimeDistributionPeriod	5000		
		7 MaximumInactivityToClaimLasDelay	8		
		8 LasDatabaseStatusSpduDistributionPeriod	6000		
364	PRIMARY_LINK_MASTER_FLAG_VARIABLE		–	RW	LAS: True = 0xFF; non-LAS: False = 0x00
365	LIVE_LIST_STATUS_ARRAY_VARIABLE		–	R	
366	MAX_TOKEN_HOLD_TIME_ARRAY	0	0x0000×16, 0x012c×16	RW	
		1 Element1	0x012c×5, 0x0000×27		
		2 Element2	0x0000×32		
		3 Element3	0x0000×32		
		4 Element4	0x0000×32		
		5 Element5	0x0000×32		
		6 Element6	0x0000×31, 0x012c		
		7 Element7	0x012c×32		
		8 Element8	0x02		
367	BOOT_OPERAT_FUNCTIONAL_CLASS		0x01	RW	0x01 (basic device); 0x02 (LM)
368	CURRENT_LINK_SETTING_RECORD	0		R	Settings for LAS
		1 SlotTime			
		2 PerDlpduPhlOverhead			
		3 MaxResponseDelay			
		4 FirstUnpolledNodeId			
		5 ThisLink			
		6 MinInterPduDelay			
		7 NumConseeUnpolledNodeId			
		8 PreambleExtension			
		9 PostTransGapExtension			
		10 MaxInterChanSignalSkew			
		11 TimeSyncClass	4095		
369	CONFIGURED_LINK_SETTING_RECORD	0	4	RW	
		1 SlotTime	5		
		2 PerDlpduPhlOverhead	37		
		3 MaxResponseDelay	0		
		4 FirstUnpolledNodeId	12		
		5 ThisLink	186		
		6 MinInterPduDelay	2		
		7 NumConseeUnpolledNodeId	1		
		8 PreambleExtension	0		
		9 PostTransGapExtension	4		
		10 MaxInterChanSignalSkew			
		11 TimeSyncClass			

Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
370	PLME_BASIC_ CHARACTERISTICS	0		R	
		1 ChannelStatisticsSupported	0x00		
		2 MediumAndDataRatesSupported	0x4900000000000000		
		3 IecVersion	1 (0x1)		
		4 NumOfChannels	1 (0x1)		
		5 PowerMode	0 (0x0)		
371	CHANNEL_STATES	0		R	
		1 channel-1	0 (0x0)		
		2 channel-2	128 (0x80)		
		3 channel-3	128 (0x80)		
		4 channel-4	128 (0x80)		
		5 channel-5	128 (0x80)		
		6 channel-6	128 (0x80)		
		7 channel-7	128 (0x80)		
		8 channel-8	128 (0x80)		
372	PLME_BASIC_INFO	0		R	
		1 InterfaceMode	0 (0x0)		
		2 LoopBackMode	0 (0x0)		
		3 XmitEnabled	1 (0x1)		
		4 RcvEnabled	1 (0x1)		
		5 PreferredReceiveChannel	1 (0x1)		
		6 MediaTypeSelected	73 (0x49)		
		7 ReceiveSelect	1 (0x1)		
373	LINK_SCHEDULE_ACTIVATION_VARIABLE			RW	
374	LINK_SCHEDULE_LIST_ CHARACTERISTICS_ RECORD	0		R	
		1 NumOfSchedules	0		
		2 NumOfSubSchedulesPerSchedule	1		
		3 ActiveScheduleVersion	0		
		4 ActiveSheduleOdIndex	0		
		5 ActiveScheduleStartingTime	0		
375	DLME_SCHEDULE_ DESCRIPTOR.1	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
		3 TimeResolution	0		
376	DLME_SCHEDULE_ DESCRIPTOR.2	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
		3 TimeResolution	0		
377	DOMAIN.1				Read/write impossible. Get-OD possible.
378	DOMAIN.2				Read/write impossible. Get-OD possible.

A1-5-2 Descriptions for LM Parameters

The following describes LM parameters of a EXA202 transmitter.

NOTE: Do not turn off the power to the EXA202 for 60 seconds after making a change to its parameter settings.

(1) DlmeLinkMasterCapabilitiesVariable

Bit Position	Meaning	Description	Value
B3: 0x04	LAS Schedule in Non-volatile Memory	Whether the LAS schedule can (= 1) or cannot (= 0) be saved to the non-volatile memory	1
B2: 0x02	Last Values Record Supported	Whether to support (= 1) or not to support (= 0) LastValuesRecord.	0
B1: 0x01	Link Master Statistics Record Supported	Whether to support (= 1) or not to support (= 0) DlmeLinkMasterStatisticsRecord.	0

(2) DlmeLinkMasterInfoRecord

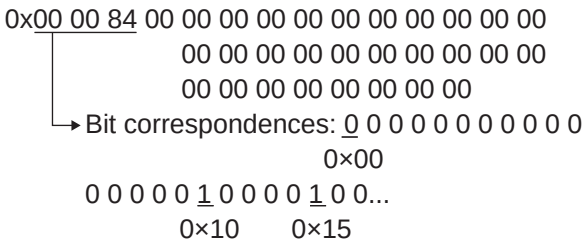
Sub-index	Element	Size [bytes]	Description
1	MaxSchedulingOverhead	1	V(MSO)
2	DefMinTokenDelegTime	2	V(DMDT)
3	DefTokenHoldTime	2	V(DTHT)
4	TargetTokenRotTime	2	V(TTRT)
5	LinkMaintTokHoldTime	2	V(LTHT)
6	TimeDistributionPeriod	4	V(TDP)
7	MaximumInactivityToClaimLasDelay	2	V(MICD)
8	LasDatabaseStatusSpduDistributionPeriod	2	V(LDDP)

(3) PrimaryLinkMasterFlagVariable

Explicitly declares the LAS. Writing “true” (0xFF) to this parameter in a device causes that device to attempt to become the LAS. However, a request of writing “true” to this parameter in a device is rejected if the value of the same parameter in any other device that has a smaller node address within the same segment is true.

(4) LiveListStatusArrayVariable

A 32-byte variable, in which each bit represents the status of whether a device on the same segment is live or not. The leading bit corresponds to the device address 0x00, and final bit to 0xFF. The value of LiveListStatusArrayVariable in the case where devices having the addresses 0x10 and 0x15 in the fieldbus segment is shown below.



(5) MaxTokenHoldTimeArray

An 8- by 64-byte array variable, in which each set of 2 bytes represents the delegation time (set as an octet time) assigned to a device. The delegation time denotes a time period that is given to a device by means of a PT message sent from the LAS within each token circulation cycle.

The leading 2 bytes correspond to the device address 0x00, and the final 2 bytes to the device address 0xFF. Specify the subindex to access this parameter.

(6) BootOperatFunctionalClass

Writing 1 to this parameter in a device and restarting the device causes the device to start as a basic device. On the contrary, writing 2 to this parameter and restarting the device causes the device to start as an LM.

(7) CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord

CurrentLinkSettingRecord indicates the bus parameter settings currently used. ConfiguredLinkSettingsRecord indicates the bus parameter settings to be used when the device becomes the LAS. Thus, when a device is the LAS, its CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord have the same values.

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	V(ST)
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	V(MRD)
4	FirstUnpolledNodeId	1	V(FUN)
5	ThisLink	2	V(TL)
6	MinInterPduDelay	1	V(MID)
7	NumConsecUnpolledNodeId	1	V(NUN)
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)
11	TimeSyncClass	1	V(TSC)

(8) DlmeBasicInfo

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	Indicates the capability value for V(ST) of the device.
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	Indicates the capability value for V(MRD) of the device.
4	ThisNode	1	V(TN), node address
5	ThisLink	2	V(TL), link-id
6	MinInterPduDelay	1	Indicates the capability value for V(MID) of the device.
7	TimeSyncClass	1	Indicates the capability value for V(TSC) of the device.
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)

(9) PlmeBasicCharacteristics

Sub-index	Element	Size [bytes]	Value	Description
1	Channel Statistics Supported	1	0	Statistics data are not supported.
2	Medium AndData Rates Supported	8	0x4900000000000000	Wire medium, voltage mode, and 31.25 kbps are supported.
3	IceVersion	2	0x0403	IEC 4.3 is supported.
4	NumOf Channels	1	1	
5	Power Mode	1	0	0: Bus-powered; 1: Self-powered

(10) ChannelStates

Sub-index	Element	Size [bytes]	Value	Description
1	Channel 1	1	0x00	In Use, No Bad since last read, No Silent since last read, No Jabber since last read, Tx Good, Rx Good
2	Channel 2	1	0x80	Unused
3	Channel 3	1	0x80	Unused
4	Channel 4	1	0x80	Unused
5	Channel 5	1	0x80	Unused
6	Channel 6	1	0x80	Unused
7	Channel 7	1	0x80	Unused
8	Channel 8	1	0x80	Unused

(11) PlmeBasicInfo

Sub-index	Element	Size [bytes]	Value	Description
1	InterfaceMode	1	0	0: Half duplex; 1: Full duplex
2	LoopBackMode	1	0	0: Disabled; 1: MAU; 2: MDS
3	XmitEnabled	1	0x01	Channel 1 is enabled.
4	RcvEnebled	1	0x01	Channel 1 is enabled.
5	PreferredReceive Channel	1	0x01	Channel 1 is used for reception.
6	MediaType Selected	1	0x49	Wire medium, voltage mode, and 31.25 kbps are selected.
7	ReceiveSelect	1	0x01	Channel 1 is used for reception.

(12) LinkScheduleActivationVariable

Writing the version number of an LAS schedule, which has already been downloaded to the domain, to this parameter causes the corresponding schedule to be executed. On the other hand, writing 0 to this parameter stops execution of the active schedule.

(13) LinkScheduleListCharacteristicsRecord

Sub-index	Element	Size [bytes]	Description
1	NumOf Schedules	1	Indicates the total number of LAS schedules that have been downloaded to the domain.
2	NumOfSub SchedulesPer Schedule	1	Indicates the maximum number of sub-schedules an LAS schedule can contain. (This is fixed to 1 in the Yokogawa communication stacks.)
3	ActiveSchedule Version	2	Indicates the version number of the schedule currently executed.
4	ActiveSchedule OdIndex	2	Indicates the index number of the domain that stores the schedule currently executed.
5	ActiveSchedule StaringTime	6	Indicates the time when the current schedule began being executed.

(14) DlmeScheduleDescriptor
This parameter exists for the same number as the total number of domains, and each describes the LAS schedule downloaded to the corresponding domain. For the domain to which a schedule has not yet been downloaded, the values in this parameter are all zeros.

Sub-index	Element	Size [bytes]	Description
1	Version	2	Indicates the version number of the LAS schedule downloaded to the corresponding domain.
2	Macrocycle Duration	4	Indicates the macro cycle of the LAS schedule downloaded to the corresponding domain.
3	TimeResolution	2	Indicates the time resolution that is required to execute the LAS schedule downloaded to the corresponding domain.

(15) Domain
Read/write: impossible; get-OD: possible
Carrying out the GenericDomainDownload command from a host writes an LAS schedule to the domain.

A1-6 FAQs

Q1. When the LAS stops, a EXA202 does not back it up by becoming the LAS. Why?

A1-1. Is that EXA202 running as an LM? Check that the value of BootOperatFunctionalClass (index 367) is 2 (indicating that it is an LM).

A1-2. Check the values of V(ST) and V(TN) in all LMs on the segment and confirm that the following condition is met:

EXA202		Other LMs
V(ST) 3 V(TN)	<	V(ST) 3 V(TN)

Q2. How can I make a EXA202 become the LAS?

A2-1. Check that the version numbers of the active schedules in the current LAS and the EXA202 are the same by reading:

LinkScheduleListCharacteristicsRecord (index 374 for a EXA202)

- ActiveScheduleVersion (subindex 3)

A2-2. Make the EXA202 declare itself as and become the LAS by writing:

- 0x00 (false) to PrimaryLinkMasterFlagVariable in the current LAS; and
- 0xFF (true) to PrimaryLinkMasterFlagVariable (index 364) in the EXA202.

Q3. On a segment where a EXA202 works as the LAS, another device cannot be connected. Why?

A3-1. Check the following bus parameters that indicate the bus parameter as being the LAS for the EXA202 and the capabilities of being the LAS for the device that cannot be connected:

- V(ST), V(MID), and V(MRD) of EXA202: ConfiguredLinkSettingsRecord (index 369)
- V(ST), V(MID), and V(MRD) of problematic device: DlmeBasicInfo

Then, confirm that the following conditions are met:

EXA202		Problematic Device
V(ST)	>	V(ST)
V(MID)	>	V(MID)
V(MRD)	>	V(MRD)

A3-2. Check that the node address of the problematic device does not lie within either 0x00 to 0x10 or the range of unused (unpolled) node addresses determined by the EXA202's LM parameter settings, which is 0x00 to 0x10 or V(FUN) to V(FUN) + V(NUM). (Refer to Section 3-3-2, “Network Definition.”)

Revision Record

Manual Title : EXA202 Fieldbus Communication
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Edition	Date	Remark (s)
1st	Apr. 2007	Newly published
2nd	Sep.2007	Revised as follows p1-1 IM No. to be refered revised; p3-2 Figure No. to be refered corrected; p3-4 Some error correction of Table 3.1; p3-7, p3-12 Section No. to be refered corrected; p3-19 Error of reference Table No. for XD_SCALE corrected; p3-20 Some error correction; p3-30 Error of reference Table No. for XD_ SCALE corrected; p3-34, p3-37, p3-40 Some error correction; p4-8 Some error correction of Sec 4-4-1; p5-3 Some error correction.

User's Manual

EXA 202
Fieldbus Communication

Supplement

Thank you for selecting our EXA202 Fieldbus Communication.
User's Manual, IM12A00A01-61E, 2nd Edition, supplied with the product, some revisions/additions have been made. Please replace the corresponding pages in your copy with the attached, revised pages.

Revisions:
- Page 3-19, Some revision of Table 3.19 and 3.20, because Unit Index Code has been corrected.
- Page 3-54, Operational Precaution with FieldMate added.

YOKOGAWA
Yokogawa Electric Corporation

IM12A00A01-61E
2nd Edition

DO202
1: Dissolved Oxygen,
2: Temperature,
3: Percent Saturation,
4: Sensor Current

Channel	Value	Unit
1	primary_value	primary_value_range.units
2	secondary_value	secondary_value_unit
3	percent_saturation	%
4	sensor_current	nA

XD_SCALE/OUT_SCALE:
Scaling information is used for two purposes. Display devices need to know the range for bar graphs and trending, as well as the units code. Control blocks need to know the range to use internally as percent of span, so that the tuning constants may remain dimensionless. This is converted back to a number with units by using the range of OUT_SCALE. The AI block has the parameter XD_SCALE to define the units expected from the transducer.

Transducer scaling (XD_SCALE) is applied to the value from the channel to produce the FIELD_VAL in percent. The XD_SCALE units code must match the channel units code.
The EXA transmitter does this automatically when the Service Codes are changed. See table 3.18 to 3.21 for the Service codes and their results.
If L_TYPE is set to Indirect or Ind Sqr Root, OUT_SCALE determines the conversion from FIELD_VAL to the output. PV and OUT always have identical scaling. OUT_SCALE provides scaling for PV. The PV is always the value that the block will place in OUT if the mode is Auto.

Table 3.18 Unit Index by XD_SCALE PH202

Channel	FF parameters	Service code	XD_SCALE.UNITS
1	-	SC01 (set to 0)	pH
2	2029	SC11 (set to 0)	ºC
2	2029	SC11 (set to 1)	ºF
3	-	SC01 (set to 1)	mV
3	-	SC01 (set to 0), SC02 (set to 1)	mV
3	-	SC01 (set to 0), SC02 (set to 2)	rH

Table 3.19 Unit Index by XD_SCALE SC202

Channel	FF parameters	Service code	XD_SCALE.UNITS
2	2023	SC11 (set to 0)	°C (1001)
2	2023	SC11 (set to 1)	°F (1002)
1, 3	-	SC01 (set to 1)	Ω•cm (1295)
1, 3	-	SC01 (set to 0)	S/cm (1680)
4	-	Default %	% (1342)

Table 3.20 Unit Index by XD_SCALE ISC202

Channel	FF parameters	Service code	XD_SCALE.UNITS
2	2023	SC11 (set to 0)	°C (1001)
2	2023	SC11 (set to 1)	°F (1002)
1, 3	-	Default S/cm	S/cm (1680)
4	-	Default %	% (1342)

◆ **Operational Precaution**

This document supplements information regarding Operational Precaution.
Operate the product carefully based on the following note.

Display on the FieldMate (*)

With using Yokogawa's FieldMate on the Fieldbus communication of the EXA202 Series instrument, even when unit setting is changed on the instrument, units on AI function blocks on the FieldMate are not changed.
Process values on the FieldMate are changed to their new process values for the new units.
After changing settings on the instrument, upload the new settings to the FieldMate.

Uploading function on the FieldMate (*)

With using Yokogawa's FieldMate on the Fieldbus communication of the EXA202 Series instrument, uploading the instrument's setting to the FieldMate starts with showing an indicator window.
On this window, progression of uploading is indicated by a bar and a percentage.
Occasionally this percentage on the window doesn't reach 100%, although uploading is finished.
In this case, just close the indicator window.

(*) FieldMate is a communication tool for HART and Fieldbus.